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Comprehensive Review of Conjunctivitis: Causes, Symptoms, and Evidence-Based Treatments

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Abstract

Conjunctivitis, commonly referred to as pink eye, is a prevalent ocular condition characterized by inflammation of the conjunctiva, the thin membrane covering the inner surface of the eyelids and the white part of the eye. This comprehensive review aims to provide a thorough understanding of conjunctivitis, including its causes, symptoms, and evidence-based treatments. The causes of conjunctivitis can be broadly categorized into infectious and non-infectious etiologies. Infectious conjunctivitis is primarily caused by viral or bacterial pathogens, while non-infectious conjunctivitis may result from allergies, irritants, or underlying systemic conditions. Symptoms of conjunctivitis typically include redness, itching, tearing, and discharge from the eyes. Depending on the underlying cause, additional symptoms such as blurred vision, photophobia, and foreign body sensation may also be present. Proper diagnosis of conjunctivitis involves a comprehensive eye examination, including patient history and, if necessary, laboratory testing or culture. Evidence-based treatments for conjunctivitis vary depending on the etiology. Viral conjunctivitis is usually self-limiting and may resolve without specific treatment, although supportive care with lubricating eye drops or cold compresses can help alleviate symptoms. Bacterial conjunctivitis often responds well to topical antibiotics, whereas allergic conjunctivitis may require antihistamines or mast cell stabilizers for symptom relief. Non-pharmacological interventions such as avoiding allergens or irritants can also be beneficial in managing conjunctivitis. This review highlights the importance of accurate diagnosis and appropriate management strategies based on the underlying cause of conjunctivitis. Additionally, preventive measures such as hand hygiene and avoiding close contact with individuals experiencing symptoms of conjunctivitis are essential in reducing the spread of infectious forms of the condition. Further research into novel treatment modalities and the long-term outcomes of conjunctivitis is warranted to optimize patient care and improve clinical outcomes.

Keywords: *Viral Conjunctivitis, Infectious, Bacterial Conjunctivitis, Ophthalmia, Dry eye, Adenoviruses.*

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1. INTRODUCTION

The inflammation or infection of the conjunctiva is known as conjunctivitis. It might either be contagious or not. Numerous factors, including bacterial, viral, chlamydial, fungal, and parasitic infections, can result in infectious conjunctivitis. Noninfectious conjunctivitis can be brought on by irritants, toxins, and allergies. Staphylococcus aureus, Streptococcus pneumoniae, Haemophilus influenzae, Neisseria gonorrhoeae, Chlamydia trachomatis, and diphtheria are examples of common bacterial pathogens. Adenovirus, herpes simplex, herpes zoster, and enterovirus are examples of common viral agents [1][2].

Seasonal allergic conjunctivitis, perennial allergic conjunctivitis, vernal keratoconjunctivitis (VKC), atopic keratoconjunctivitis (AKC), and large papillary conjunctivitis are all included in the category of allergic conjunctivitis. Floppy eyelid syndrome, medication-induced keratoconjunctivitis, and contact lens-related keratoconjunctivitis are a few instances of irritant- and toxin-induced conjunctivitis.

There are two further categories of conjunctivitis: acute and chronic. Acute conjunctivitis is typified by beginning three to four weeks after presentation, while chronic conjunctivitis lasts longer than four weeks. It is possible to differentiate between acute and chronic conjunctivitis based on an evaluation of the appearance of the discharge, physical examination results, and related symptoms[3][4][5]. In primary care, conjunctivitis is a frequent issue.

Every age group and socioeconomic background is impacted. Instead of seeing an ophthalmologist, around 70% of individuals with acute conjunctivitis see their primary care physician or an urgent care facility. Studies have indicated that 6 million Americans suffer with conjunctivitis each year, accounting for 1% of all visits to primary care offices. In terms of missed work productivity, medical visit costs, and treatment costs, the financial burden is substantial.

An estimated $377 million to $875 million is spent on bacterial conjunctivitis each year in the United States, accounting for over half of all instances of conjunctivitis. Rarely does acute conjunctivitis result in lasting visual loss; instead, it normally resolves on its own. Nonetheless, it's critical to rule out further red eye conditions that might impair vision.

Primary care physicians should be knowledgeable with typical differential diagnoses for red eye conditions. To guarantee high-quality patient care, prompt referrals to ophthalmologists need appropriate decision-making. The conjunctiva is a transparent, lubricating mucous membrane that covers the palpebral (underside of the eyelid) and bulbar (surface of the globe) surfaces[6][7][8].

Conjunctivitis can be categorized in a number of ways, including according to its etiology, chronicity, severity, and degree of surrounding tissue involvement. Conjunctivitis can have either an infectious or non-infectious etiology. While allergy and toxin-induced conjunctivitis are among the most prevalent non-infectious etiologies, viral and bacterial conjunctivitis are the most common causes of infectious conjunctivitis. Conjunctivitis can be classified as acute, sub-acute, or chronic depending on how long it lasts.

Acute conjunctivitis has a quick start and lasts four weeks or less. In addition, those with conjunctivitis may be classified as having severe cases if they have a lot of mucopurulent discharge and severe symptoms. When blepharoconjunctivitis or viral keratoconjunctivitis affect the cornea and eyelid margins, respectively, conjunctivitis may also invade these surrounding tissues [9][10][11].

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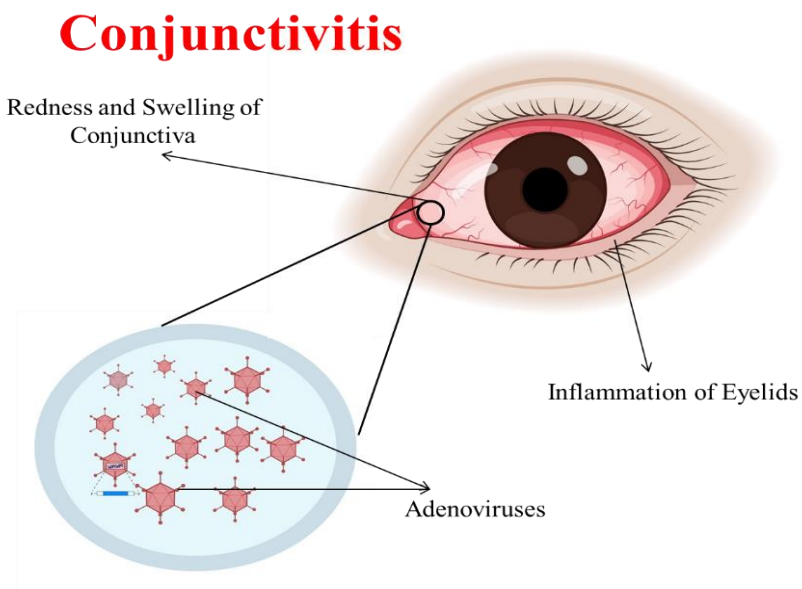

Figure 1: Viral conjunctivitis

Risk factors

1. Age: children have the highest incidence
2. Seasonal allergies
3. Exposure to known allergens
4. Sharing towels or linens with a person who has conjunctivitis
5. Use of contact lenses

Comorbidities

1. Ocular dryness
2. Dysfunction of the meibomian glands or blepharitis
3. Trachoma
4. Intolerance to contact lenses or excessive use

2) Lacrimal infection: persistent canaliculitis, persistent dacryocystitis

3) Masquerading syndromes: sebaceous cell carcinoma, intraepithelial neoplasia, and malignant melanoma

4) Elevated cortical keratoconjunctivitis 8. Syndrome of floppy eyelids

Furthermore, immune-related disorders (e.g., Reiter's, Stevens-Johnson syndrome (SJS), and keratoconjunctivitis sicca in rheumatoid arthritis), nutritional deficiencies (e.g., vitamin A deficiency), and congenital metabolic syndromes (e.g., Richner-Hanhart syndrome and porphyria) may also be linked to conjunctivitis. It is critical to distinguish conjunctivitis from other "red eye" conditions as acute angle closure glaucoma, uveitis, endophthalmitis, carotid-cavernous fistula, cellulitis, and anterior segment tumors that can seriously impair vision or even pose a threat to life [12][13].

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Table 1: Symptom criteria

Symptoms	Allergic Conjunctivitis	Bacterial Conjunctivitis	Viral Conjunctivitis
The appearance of discharge from the eyes	stringy white mucoid	Mucopurulent	Watery
Presence of erythema	Mild to moderate	Moderate to severe	Mild to moderate
Pruritus	Moderate to severe	None to mild	Mild to moderate
Involvement of both eyes	None	Rare	common
Upper respiratory coinfection	None	Rare	Common

1.1 Methods for diagnosing otitis media

A common presentation for many ocular conditions is conjunctival injection, also known as "red eye," which may account for up to 1% of primary care visits. Whether or not they are ophthalmologists, clinicians need to be aware that "red eye" can be a symptom of more benign conditions that only affect the conjunctiva, such as conjunctivitis or subconjunctival hemorrhage, or it can be the secondary symptom of more serious conditions like uveitis, keratitis, or scleritis. It was once thought that severe eye problems were linked to visual abnormalities, incapacitating discomfort, and photophobia. Anisocoria and moderate photophobia, on the other hand, were shown to be substantially related with "serious eye conditions" in a recent comprehensive meta-analysis; the presence of these two indicators could identify 59% of instances of "serious eye conditions," which included keratitis and anterior uveitis [14][15][16][17].

1.2. How to differentiate between conjunctivitis that is infectious and that is not

To get the right diagnosis when a patient presents with conjunctivitis, it is essential to get their medical history. Focused ocular history should include the following: when the symptoms started and how long they lasted; laterality; visual impairment; itching; history of wearing contact lenses; presence of fellow travellers with recent upper respiratory infections, sinusitis, and lymphadenopathy; history of conjunctivitis episodes in the past; systemic allergies and medication; and history of chemical agent exposure [18][19][20].

The differential diagnosis is further reduced by the existence of constitutional symptoms such as fever, malaise, exhaustion, and interaction with conjunctivitis sufferers. It is crucial to perform a physical examination and look for palpable lymph nodes, particularly in the periauricular and submandibular regions. The kind of discharge should be identified by an ophthalmic examination. It is imperative to perform a more thorough examination using a slit-lamp biomicroscope in order to assess the ocular surface structures, such as the corneal tissue for opacities and infiltrates and the palpebral conjunctiva for the existence of pseudomembranes, symblepharon, papilla, or follicles [21][22].

Eye discharge, conjunctival injection, presence of red eye(s), lashes stuck together in the morning, grittiness of the eye(s), eyelid or conjunctival edema, and history of contact with conjunctivitis sufferers are some of the clinical signs and symptoms that are used to help diagnose infectious conjunctivitis [23].

It's possible that allergic conjunctivitis is underdiagnosed and treated. It shows up as redness, chemosis, and itching without any noticeable corneal involvement. Conjunctival edema frequently exceeds the range of conjunctival hyperemia. The appearance of gigantic papillae in the superior tarsal conjunctiva together with intense itching is the predominant finding in vernal keratoconjunctivitis (VKC), whereas the diagnosis of atopic keratoconjunctivitis (AKC) is supported by the presence of an anterior subcapsular cataract and conjunctival scar [24][25].

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1.3. How to differentiate between conjunctivitis caused by bacteria and viruses

Making a diagnosis of conjunctivitis based just on the symptoms and indications that are present can frequently lead to an incorrect conclusion. In one study, the accuracy rate of correctly diagnosing adenoviral conjunctivitis was just 48% among centers with experience in ocular surface diseases. Only 50% of suspected instances of bacterial conjunctivitis had bacterial pathogens identified, according to several additional investigations. Furthermore, according to one study, up to 52% of suspected instances of viral conjunctivitis had positive bacterial cultures [26][27].

The following correlations between the etiology of conjunctivitis and the clinical history were conventionally accepted as valid; these concepts were included in several textbooks and were applied in the patient selection process for numerous clinical studies. For instance, involvement in one eye followed by involvement in the other within 24–48 hours is suggestive of bacterial infection, according to the major ophthalmology text books (e.g., Krachmer, Duane, and Kanski). If, on the other hand, the second eye becomes infected after 48 hours and there is an accompanying enlarged periauricular lymph node, a viral etiology should be taken into consideration. The same textbooks state that a follicular conjunctival reaction is more likely to imply a viral etiology for conjunctivitis, but a papillary conjunctival reaction or pseudomembranous conjunctivitis strongly implies a bacterial origin for conjunctivitis [28][29][30].

There are several more hypothesized but weakly supported clinical correlations between the etiology of conjunctivitis and symptoms. For instance, the link between bacterial conjunctivitis and the absence of itching has been questioned recently. Previously believed to be true but lacking evidence are other associations: sinusitis, fever, malaise, and fatigue in association with bacterial conjunctivitis; recent upper respiratory tract infection and lymphadenopathy in favor of viral conjunctivitis; and a history of conjunctivitis with bilateral involvement of the eyes in favor of viral and allergic but not bacterial conjunctivitis [31][32].

A 2003 meta-analysis was unable to locate any clinical research linking the symptoms and indicators of conjunctivitis to the underlying cause of the condition. A prospective investigation was carried out after the aforementioned meta-analysis, and the results indicated that a combination of three signs—bilateral mattering of the eyelids, absence of itching, and no prior history of conjunctivitis—were highly predictive of bacterial conjunctivitis. A positive bacterial culture was more likely if both eyes were present and their eyelashes stayed together in the morning. It was less likely if the patient itched or had ever had conjunctivitis. Neither the discharge type (purulent, mucusy, or watery) nor any other symptom was exclusive to a certain conjunctivitis class [33][34][35].

Patients with purulent discharge or mild to moderate red eye were less likely to benefit from topical antibiotics, according to a more recent meta-analysis that examined the clinical data of 622 patients from three clinical trials. This finding reinforces the lack of meaningful correlation that exists between signs and symptoms and the underlying etiology in the majority of conjunctivitis cases. Another recent study from 2013 discovered that patients who had "glueing of the eyelids" when they wake up in the morning and who are older than 50 when they present have a high chance of having positive bacterial culture findings [36][37].

2. PREVALENCE AND INCIDENCE

The underlying cause of conjunctivitis affects the prevalence of the condition and can be affected by the patient's age and the time of year. The most common cause overall is allergic conjunctivitis, which affects 15% to 40% of people and is most commonly seen in the spring and summer.

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An adenovirus is assumed to be the source of 65% to 90% of viral conjunctivitis, which is most common in the summer. Between 20% and 70% of infectious conjunctivitis is thought to be viral. The majority of instances of infectious conjunctivitis in children are caused by bacterial conjunctivitis, which is also the second most prevalent cause of the condition [38][39][40]. December through April is the months when it is most commonly noticed. The most prevalent bacterial pathogen in newborns is N gonorrhea, the most prevalent in babies and toddlers is H. influenza, and the most prevalent in school-aged children and adults is S aureus. Hand cleaning and patient education are crucial in stopping the spread of infectious conjunctivitis. Numerous illnesses and comorbidities are linked to conjunctivitis.

A stratified sample of 20% of US hospital-based emergency departments (EDs) makes up the National Emergency Department Sample (NEDS), a population-based data set. Post stratification weights are used to extrapolate national estimates. We computed nationwide estimates, stratified by age, sex, and calendar month, of encounters with a main diagnosis of acute conjunctivitis from January 1, 2010, to December 31, 2013. Ethics clearance and informed consent were not necessary for the analysis of this publicly available deidentified data collection since it did not fit the University of California, San Francisco's institutional review board's definition of research involving human subjects. Using population estimates from the 2010 US decennial census as the denominator, we approximated the incidence of conjunctivitis diagnosed in the ED [41][42][43][44].

In the NEDS data set from 2010 to 2013, there were 555740 encounters in US EDs that led to a primary diagnosis of conjunctivitis. Conjunctivitis diagnosed in the emergency department (ED) was bimodally distributed, with children under the age of seven having the greatest rates and early adults having a minor mode. When we limited the study to individuals 18 years of age or older, we found that conjunctivitis was more prevalent in women than in males, with a minor mode at 22 years in women and 28 years in men. Cases of conjunctivitis showed strong seasonality across all age groups. When categorized by age category, conjunctivitis presentations peaked in March for children 0 to 4 years old, and peaked in May for all other age groups. With more detailed conjunctivitis codes, there was no difference in the peak age incidence or seasonality pattern. Regional variations in seasonal trends were noted [44][45][46].

3. PREVENTION AND TREATMENT OF CONJUNCTIVITIS

The main defense against infectious conjunctivitis is proper personal cleanliness.

- Though rare, bacterial conjunctivitis can be transmitted by hand-to-mouth contact or upper respiratory tract infections. Hands can carry gonococcal infection from the vaginal tract or urine to the eye. There has been a major violation of standard hygiene. Using tetracycline eye ointment, povidone iodine drops, or other antiseptics or antibiotics from birth can help avoid ophthalmia neonatorum [47][48].
- Adenovirus-induced viral conjunctivitis has the ability to spread swiftly throughout a community or establishment like a school. Because of its high contagiousness, this must be contained by enforcing stringent cleanliness regulations. Towels, face cloths, hands, and applanation tonometers are just a few instances of how readily this may spread [49][50].
- Unless the patient is able to modify their work environment or surroundings or identify and eliminate the allergen (such as pollen or animal fur), allergic conjunctivitis cannot be prevented. Substance usage might result in allergies, which can be resolved by quitting the substance. Preservatives in eye drops, atropine, and neomycin are very frequent sources of these medication responses [51][52].

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3.1 How do laboratory findings help us?

When treating conjunctivitis in the eyes, clinicians may take discharge samples and submit them for microbiological analysis. In cases of suspected infectious newborn conjunctivitis, recurrent conjunctivitis, conjunctivitis resistant to treatment, conjunctivitis presenting with significant purulent discharge and cases suspicious for gonococcal or chlamydial infection, conjunctival cultures are often retained [53][54].

It is preferable to take discharge swabs before to starting antibiotic treatment. After that, the swabs are plated in different growth media in the lab to create cultures. When diagnosing fungus on Sabouraud agar plates, individuals with immunocompromised or persistent blepharitis should employ this technique. Anaerobic culture plates might also be beneficial, particularly for those who have had prior trauma or surgery [5][55].

Antimicrobial treatment should be halted 48 hours before acquiring cultures if it has already been initiated. Coagulase-negative staphylococci were the most prevalent pathogens in a five-year study of 138 pediatric ocular surface infections, followed by Pseudomonas aeruginosa and Staphylococcus aureus [56].

The diagnosis of viral infections can be achieved by nucleic acid amplification techniques, which need specific swabs. Numerous polymerase chain reaction (PCR) assays are available for virus identification. Primary investigations on in-office fast antigen testing for adenoviruses show up to 94% specificity and 89% sensitivity, respectively. More recent research indicates that there is a good specificity but only a modest sensitivity, ranging from 39.5% to 50%. Skin scratch tests, intradermal injections of common allergens, and assays for identifying high in vitro levels of certain serum IgE can all be used to evaluate individuals suspected of having allergic conjunctivitis; nonetheless, the diagnosis of allergic conjunctivitis is still made clinically [57][58].

The conjunctivitis virus:

The most frequent cause of infectious conjunctivitis overall is viral conjunctivitis, which often develops as a result of adenovirus inoculation of the ocular surface. Less commonly, other viruses—among which herpes simplex virus (HSV), varicella zoster virus (VZV), and enterovirus have been the focus of research—may be the underlying cause of viral conjunctivitis [59][60].

Conjunctivitis caused by viruses:

Adenoviruses are the primary cause of infectious conjunctivitis globally, accounting for up to 90% of instances of viral conjunctivitis. Human adenoviruses (HAdV) contain approximately 72 distinct genotypes that have been grouped into seven different species (HAdV-A through HAdV-G). The HAdV-D species has the most members and the highest correlation with viral conjunctivitis. These findings are the result of recent advancements in HAdV genome sequencing [61][62].

Pharyngoconjunctival fever (PCF) is a prevalent form of adenovirus infection in children, primarily caused by types 3, 4, and 7. Fever, pharyngitis, periauricular lymphadenopathy, and acute follicular conjunctivitis are the common symptoms of this illness. Pro-inflammatory cytokines and the conjunctival vasculature interact to cause edema, hyperemia, and petechial hemorrhages of the conjunctiva, among other ocular surface abnormalities. This is a self-limiting illness that frequently goes away on its own in two to three weeks without any medical intervention. Epidemiological keratoconjunctivitis (EKC) is the most severe ocular manifestation of adenoviral infection; it affects the cornea as well as the conjunctiva, resulting in irreversible and long-lasting ocular surface damage. Alterations and disruptions in vision, Conjunctival discharge, follicular conjunctivitis, corneal sub epithelial infiltrates (SEI), corneal scarring, development of conjunctival membranes and pseudo

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membranes, and symblepharon formation are among the ocular signs of EKC. Serotypes 8, 19, 37, and, less commonly, serotype 4 were formerly thought to be linked to EKC; however, more recently, HAdV-D53 and HAdV-D54 have been found in many outbreaks and are assumed to comprise the majority of EKC cases [63][64][65].

Patients with EKC may develop pseudo membranes in their tarsal conjunctiva, which are sheets of fibrin-rich exudates devoid of lymphatic or blood vessels.[35] In cases with EKC, genuine conjunctival membranes may also emerge, depending on the severity of inflammation. Once formed, true membranes have the tendency to bleed profusely when removed and can cause symblepharon and subepithelial fibrosis. Another tissue that might suffer from EKC is the cornea. Viral replication in the corneal epithelium can result in focal regions of epithelial opacities after superficial punctctate keratopathy. These opacities may be linked to astigmatism, photophobia, and visual disturbances, and they may last for years. There have been reports indicating that the incidence of SEI development in EKC ranges from 49.1 to 80% [62][66][61].

The underlying mechanism for the development of SEIs is thought to be an immune response to the multiplying adenoviruses in anterior stromal keratocytes. The theory is supported by the finding that these opacities return after stopping steroids. According to some accounts, adenovirus conjunctivitis can spread up to 50% of the time and is very infectious [67].

Viral conjunctivitis can be transmitted by sharing personal goods, infected fingers, medical instruments, contaminated water at swimming pools, or by sharing personal belongings. In one research, up to 46% of patients had positive viral cultures generated from their hands. The American Academy of Ophthalmology advises disinfecting office supplies and equipment against common infectious organisms found in eye care clinics, such as adenoviruses, using a 1:10 diluted bleach solution (sodium hypochlorite). It has been advised to frequently wash hands, meticulously disinfect medical equipment, and isolate conjunctivitis patients from other patients in the healthcare provider's office due to the extremely infectious nature of viral conjunctivitis [68][59].

The adenovirus takes between 5 to 12 days to incubate, and those who are sick can spread the illness for up to 14 days after contracting it.

While there isn't a single, efficient therapy for viral conjunctivitis, many of the clinical symptoms tend to be relieved by using cold compresses, antihistamine-containing eye drops, or regular artificial tears. Increased bacterial resistance and the potential for illness transmission to the contralateral eye through cross-contamination with contaminated bottles are two additional issues with taking antibiotic drops [69].

After anaesthetizing the ocular surface, membranes or pseudo membranes can be peeled at the slit-lamp with a cotton swab or a pair of jeweler's forceps. The purpose of this is to reduce patient discomfort and stop new scarring from forming. A pilot research examined the use of povidone-iodine 2% as a monotherapy for viral conjunctivitis. The illness was completely resolved in three-quarters of the eyes when the authors used topical Povidone-iodine 2% four times a day for a week [66].

Topical corticosteroids are recommended by the American Academy of Ophthalmology to be effective in treating conjunctivitis, but only in certain circumstances and with extreme caution. When viral conjunctivitis is accompanied by membrane development and sub-epithelial infiltration, acute photophobia and reduced vision are indicators that steroids should be used. The primary side effects of indiscriminate topical corticosteroid usage include increased intraocular pressure, worsening of HSV keratitis, and prolongation of adenoviral conjunctivitis. It has been found that prolonged viral shedding occurs after corticosteroid monotherapy. On the other hand, combined treatments using

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corticosteroids and antibiotics or other anti-infective drugs have shown promise in the treatment of bacterial and viral conjunctivitis [70][71].

Conjunctivitis caused by Methicillin-resistant S. aureus

Staphylococcus aureus species that are resistant to the drug methicillin are referred to as methicillin-resistant S. aureus (MRSA); however, the term is now also used to denote resistance to all β-lactam antimicrobials. MRSA conjunctivitis, which is becoming more common, accounts for 3–64% of all ocular Staphylococcus conjunctival infections. Eye drops or ointments containing fortified vancomycin must be used to treat suspected instances. Limiting the spread of MRSA conjunctivitis requires the application of culture-directed antibiotic administration, suitable antiseptic methods, efficient dosage, and consideration of local resistance trends [72][73][74].

Conjunctivitis chlamydial

Numerous ocular surface diseases, such as trachoma, inclusion conjunctivitis, and newborn conjunctivitis, can be brought on by Chlamydia trachomatis. Neonatal and adult inclusion conjunctivitis are caused by serotypes D–K, whereas trachoma is caused by serotypes A, B, Ba, and C. It has been found that 1.8–5.6% of instances of acute conjunctivitis are caused by inclusion conjunctivitis [75][76].

Patients frequently arrive with mild follicular conjunctivitis and mucopurulent discharge that lasts for several weeks or months. According to reports, up to 74% of women and 54% of males experience concurrent genital infections. Topical antibiotic addition is not helpful; treatment with systemic antibiotics, such as oral azithromycin and doxycycline, is effective. It is necessary to start treating sexual partners and looking for signs of gonorrhea co-infection. 40 million people worldwide are afflicted with trachoma, the most common cause of infectious blindness in the world. The illness is more common in places with inadequate hygiene. Even though mucopurulent discharge is the first symptom to appear, blindness may eventually result from corneal, conjunctival, and eyelid scarring. It is quite beneficial to take one dosage of oral azithromycin (20 mg/kg) together with three weeks of oral erythromycin or tetracycline. Additionally, patients may receive six weeks of treatment with topical antibiotic ointments including erythromycin and tetracycline [77][78][79].

Chlamydia can result in conjunctivitis in infants after they pass through an infected birth canal.

The acute phase is characterized by purulent discharge, erythema, and edema of the eyelids and conjunctiva. It usually starts between days 5 and 14 after vaginal birth.

Newborn conjunctivitis secondary to C. trachomatis is more common than gonococcal conjunctivitis (GC) and is regarded as the most common infectious cause of newborn conjunctivitis globally [80].

3.2. Pharmacological Treatment:

The cornerstone of therapy for many types of allergies, including allergic conjunctivitis, is avoiding the allergens. Artificial tears serve as a barrier, dilution of different allergens, and cleansing of the ocular surface from many inflammatory mediators.

Antihistamines, mast cell stabilizers, and lubricating eye solutions are among the treatments for allergic conjunctivitis. Numerous studies have shown that topical antihistamines and mast cell stabilizers are more effective than placebo in reducing the symptoms of allergic conjunctivitis. Moreover, it has been shown that antihistamines are more helpful than mast cell stabilizers in providing temporary relief [81][82].

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In recent years, a number of eye drop formulations including olopatadine, ketotifen, azelastine, and epinastine with dual action (antihistamine and mast cell stabilizing actions) have been brought to market. These substances can stabilize mast-cell membranes; act as simultaneous histamine receptor antagonists [83].

Mast cell stabilizers should ideally be given prior to the antigen exposure because they need a few weeks to fully load. Many times, people with allergic conjunctivitis can get relief from their ocular symptoms by using oral antihistamines. Antihistamines from the second generation are recommended since they have less negative systemic side effects. Sadly, oral antihistamines cause eye dryness, which can severely exacerbate allergic conjunctivitis symptoms. It is important to utilize steroids sparingly and in the right situations. If the situation is severe, topical and oral treatment may also be necessary in addition to supratarsal injections; regrettably, any method of corticosteroid administration is linked to cataract development and increased intraocular pressure. To get even more advantages, non-steroidal anti-inflammatory medications like diclofenac and ketorolac might be added to the treatment plan [84].

Furthermore, tacrolimus and cyclosporine-A are two other steroid-sparing medications that are useful in treating severe and long-term ocular allergy conditions.

The mechanism of action of allergen-specific immunotherapy, which has grown in favor recently, is the induction of clinical tolerance to a particular allergen. This seems to be a useful course of treatment for those with particular IgE antibodies and allergic rhinoconjunctivitis[85][86].

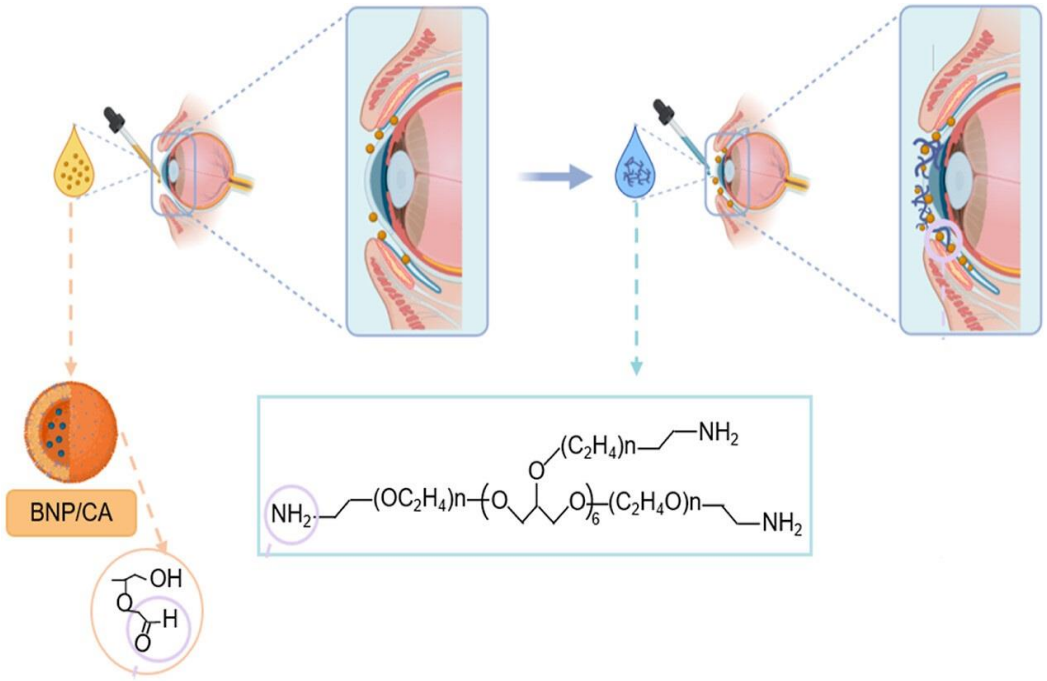

Figure 2: Treatment of Bacterial Conjunctivitis by a Bioadhesive Nanoparticle

Immunotherapy is often administered by subcutaneous injections; however, allergists are becoming more aware of sublingual immunotherapy (SLIT) as a potential substitute. It has been demonstrated that SLIT is beneficial in reducing the nasal and ocular symptoms of allergic conjunctivitis, having a stronger impact on alleviating the nasal symptoms [87][88].

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Table 2: Management of red eye in primary care

Action	Condition	DESCRIPTION
Referral	**Acute angle closure Glaucoma**	Severe discomfort in the eyes, reduced vision, color haloes surrounding lights, hazy cornea, fixed mid-dilated pupil, elevated intraocular pressure, and systemic symptoms (such as nausea, vomiting, headaches)
	Uveitis	Palpable soreness, photophobia, reduced intraocular pressure with flare-ups, impaired vision, circumcorneal congestion, and meiotic pupil
	Scleritis	Severe discomfort, soreness in the eyes, and bluish-red discoloration of the scleral tissue; linked to inflammatory diseases such as rheumatoid arthritis
	Keratitis	Whitish lesions (ulcers), redness, blurred vision, and ocular discomfort; fluorescein staining is usually recommended. often as a result of trauma or using contact lenses
Treatment	**Herpes simplex Conjunctivitis**	Especially if the Hutchinson sign is evident, a painful vesicular rash across the V1 distribution of the trigeminal cranial nerve necessitates antiviral therapy and referral to an ophthalmologist.
	Hyperacute gonococcal conjunctivitis	Conjunctival scrapings are necessary for culture and sensitivity in cases of hyperacute red eye with extensive purulent discharge. The patient and their contacts will then need to be medically managed. If there is no improvement, consider making a referral and follow up every day.
	Inclusion of chlamydial conjunctivitis	Impacts adolescents and young adults who are sexually active as well as newborns, most of whom are from impoverished nations. Keratoconjunctivitis mucopurulent that is resistant to medication. Needs to have a systemic illness evaluated and the local infection treated.
Reassurance	**Conjunctivitis**	Minimal pain, no changes in vision. Purulent discharge from bacteria; preauricular node from viruses; pruritus and especially watery discharge from allergies (typically in both eyes). In situations of infectious disease, promote proper hand and eye hygiene. Consider using ophthalmic antibiotics if, three days after the onset of symptoms, the probable bacterial cause does not improve. In seven to ten days, if symptoms do not improve, consult
	Dry eye	Dry air made the foreign body sense worse; artificial tear eye drops made it better.
	Episcleritis	Hyperemia or diffuse redness in the episcleral artery, self-limiting, and mild irritation and photophobia can all occur with or without NSAIDs. Either unplanned or painful. Not a particular therapy, but potential causes
	Sub-conjunctival hemorrhage **Gland infection**	Sores on the lid that resemble boils or longer-lasting, rubbery, non-tender chalazions (hordeolum or stye) Warm compresses may aid in the rupture and drainage of lesions.
NSAID—nonsteroidal anti-inflammatory drug, V1—fifth cranial nerve, ophthalmic division.		

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CONCLUSION

Conjunctivitis, commonly known as pink eye, is a prevalent ocular condition characterized by inflammation of the conjunctiva. This comprehensive review has examined the causes, symptoms, and evidence-based treatments associated with conjunctivitis. The causes of conjunctivitis encompass infectious and non-infectious etiologies, with viral and bacterial pathogens being the primary infectious culprits. Non-infectious conjunctivitis may arise from allergies, irritants, or systemic conditions. The hallmark symptoms of conjunctivitis include redness, itching, tearing, and discharge from the eyes, often accompanied by additional symptoms such as blurred vision and photophobia. Accurate diagnosis of conjunctivitis relies on a thorough eye examination, including patient history and, if necessary, laboratory testing or culture. Evidence-based treatments for conjunctivitis are tailored to the underlying cause. While viral conjunctivitis typically resolves on its own, supportive care with lubricating eye drops or cold compresses can alleviate symptoms. Bacterial conjunctivitis often responds well to topical antibiotics, while allergic conjunctivitis may require antihistamines or mast cell stabilizers for symptom relief. Non-pharmacological interventions, such as avoiding allergens or irritants, play a crucial role in managing conjunctivitis. Additionally, preventive measures like hand hygiene and minimizing close contact with infected individuals are vital in curbing the spread of infectious forms of the condition.

Future research efforts should focus on exploring novel treatment modalities and assessing the long-term outcomes of conjunctivitis to enhance patient care and clinical outcomes. By advancing our understanding of conjunctivitis and optimizing management strategies, healthcare professionals can effectively address this common ocular condition and improve the quality of life for affected individuals.

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