Original Research Article

International Journal of Medical and Health Research
ISSN: 2454-9142
Received: 22-05-2019; Accepted: 23-06-2019; Published: 28-07-2019
www.medicalsciencejournal.com
Volume 5; Issue 7; 2019; Page No. 223-228

Assessment of different organism responsible for acute bacterial conjunctivitis cases

Dr. Richa Choudhary[1], Dr. Sony Sinha[2*]

[1] Senior Resident, Department of Ophthalmology Patna Medical College & Hospital, Patna, Bihar, India
[2] Associate Professor, Department of Ophthalmology, Patna Medical College & Hospital, Patna, Bihar, India
[*] Corresponding Author: Dr. Sony Sinha

Abstract
Bacterial conjunctivitis can be contracted directly from infected individuals or can result from abnormal proliferation of the native conjunctival flora. Most causes of conjunctivitis are benign, with a self-limited process; however, depending on the immune status of the patient and the aetiology, conjunctivitis can progress to increasingly severe and sight-threatening infections. Chronic conjunctivitis is usually a source of frustration to both the patient and the ophthalmologist. The role of the emergency physician is to separate the conditions requiring more vigorous treatment and referral from those that can be handled satisfactorily in the emergency department. Hence based on above findings the present study was planned for Assessment of Different Organism Responsible for Acute Bacterial Conjunctivitis Cases.

The present study was planned in Department of Ophthalmology, Patna Medical College & Hospital, Patna, Bihar, India. The study was conducted from December 2018 to February 2019. In the present study 25 cases of the acute conjunctivitis referred to Department of Ophthalmology were enrolled. A complete external examination of each eye including lids, conjunctiva, cornea, preauricular and submandibular lymph nodes, slit lamp bio-microscopy of the anterior segment, application of Fluorescein to the ocular surface and Schirmer's test where needed. Condition of the lids is noted for any evidence of oedema, blepharitis, mucous crusts, madarosis, tylosis, trichiasis, ectropion, etc. Conjunctiva is examined for evidence of congestion, chemosis, ulceration, petechial haemorrhages, membrane formation, papillae, follicles, nodules, scarring, discoloration etc.

The data generated from the present study concludes that acute conjunctivitis is the common problem seen worldwide. It is generally seen in the patients with low socioeconomic status. Prevention of any disease is better than cure which happens to be very true especially regarding to acute conjunctivitis. Staphylococcus aureus, Streptococcus pneumonae, Hemophilus influenzae and Staphylococcus epididymis were most common bacteria seen in our study.

Keywords: organism, acute bacterial conjunctivitis, staphylococcus aureus, streptococcus pneumonae, etc

Introduction

The conjunctiva is a loose connective tissue that covers the surface of the eyeball (bulbar conjunctiva) and reflects back upon itself to form the inner layer of the eyelid (palpebral conjunctiva). This tissue firmly adheres to the sclera at the limbus, where it meets the cornea. The accessory lacrimal glands (Krause and Wolfring), along with goblet cells, are contained within the conjunctiva and are responsible for keeping the eye lubricated.

Conjunctivitis is one of the most common nontraumatic eye complaints resulting in presentation to the emergency department (ED): 3% of all ED visits are ocular related, and conjunctivitis is responsible for approximately 30% of all eye complaints. This term describes any inflammatory process that involves the conjunctiva; however, to most patients, conjunctivitis (often called pink eye) is a diagnosis in its own right. As with any mucous membrane, infectious agents may adhere to the conjunctiva, thus overwhelming normal defense mechanisms and producing clinical symptoms of redness, discharge, irritation, and possibly photophobia.

Cellular infiltration and exudation characterize conjunctivitis on a cellular level. Classification is usually based on cause, including viral, bacterial, fungal, parasitic, toxic, chlamydial, chemical, and allergic agents. Viral etiologies are more common than bacterial, and incidence of viral conjunctivitis increases in the late fall and early spring. Classification can also be based on age of occurrence or course of disease. The etiology often can be distinguished on clinical grounds. In keratoconjunctivitis, an associated corneal involvement is present.

Several studies demonstrate that acute conjunctivitis occurs with almost equal frequency between bacterial and viral causes. Fitch et al. noted that viral conjunctivitis occurs more frequently in the summer, and bacterial conjunctivitis occurs more often in the winter and spring.

Most causes of conjunctivitis are benign, with a self-limited process; however, depending on the immune status of the patient and the etiology, conjunctivitis can progress to increasingly severe and sight-threatening infections. The role of the emergency physician is to separate those few conditions requiring more vigorous treatment from the majority that can be handled satisfactorily in the ED.

In classic presentations, patients complain of eyelids sticking together on waking. They may describe itching and burning or a gritty, foreign-body sensation. Pus sliding across the eye may distort vision, although visual acuity is normal. Photophobia is minimal. Family members with similar complaints typically present with conjunctivitis from an infectious cause. A history of a recent upper respiratory infection (URI) is typically associated with a viral cause. In any patient with ocular complaints, perform a complete

physical examination of the eye, including visual acuity, fluorescein staining, slit-lamp examination, and tonometry.

Bilateral disease is typically infectious or allergic. Unilateral disease suggests toxic, chemical, mechanical, or lacrimal origin. Intraocular pressure, pupil size, and light response are all normal in unilateral disease, and ciliary flush, corneal staining, and anterior chamber reaction is absent unless a significant amount of keratitis is associated (as seen in epidemic keratoconjunctivitis [EKC]).

Bacterial conjunctivitis is characterized by acute onset, minimal pain, occasional pruritus, and, sometimes, exposure history. Ocular surface disease (eg, keratitis sicca, trichiasis, chronic blepharitis) predisposes the patient to bacterial conjunctivitis. Staphylococcal and streptococcal species are the most common pathogens. Preauricular adenopathy sometimes occurs; chemosis (thickened, boggy conjunctiva) is common. The conjunctival discharge is copious, thick, and purulent, and the conjunctival injection is moderate or marked.

Chlamydial conjunctivitis is characterized by chronic onset, minimal pain level, occasional pruritus, and a history of sexually transmitted disease (STD). This condition tends to be chronic with exacerbation and remission. Occasional preauricular adenopathy is present, but chemosis is rare. The conjunctival discharge amount is minimal with a seropurulent quality. There is moderate conjunctival injection.

Viral conjunctivitis is characterized by acute or subacute onset, minimal pain level, and, often, exposure history. Pruritus is common, and a clear, watery discharge is typical. Occasionally, severe photophobia and foreign-body sensation occurs, usually caused by adenovirus (epidemic keratoconjunctivitis [EKC]), when associated with keratitis. Check for preauricular adenopathy and a follicular conjunctival change, particularly on the palpebral conjunctiva. If present, the likely diagnosis is EKC. Be aware that herpes simplex and chlamydia also cause follicular conjunctivitis and preauricular adenopathy [1].

Preauricular adenopathy is common in EKC and herpes, whereas chemosis is variable. The conjunctival discharge amount is moderate, stringy, or sparse, with a thin and seropurulent quality. There is moderate or marked conjunctival injection. Allergic conjunctivitis is characterized by acute or subacute onset, no pain, and no exposure history. Pruritus is extremely common and the hallmark symptom of this condition. Clear, watery discharge is typical, with or without a moderate amount of mucus production.

An aggressive form of allergic conjunctivitis is vernal conjunctivitis in children and atopic conjunctivitis in adults. Vernal disease is often associated with shield corneal ulcers. Perilimbal accumulation of eosinophils (Horner-Trantas dots) typifies vernal disease. Vernal keratoconjunctivitis (VKC), usually affects young boys, tends to be bilateral, and occurs in warm weather. VKC is presumed to be a hypersensitivity to exogenous antigens and may be associated with or accompanied by keratoconus. Preauricular adenopathy is absent; chemosis is common. The conjunctival discharge amount is moderate, stringy, or sparse, with a clear quality. There is moderate conjunctival injection.

Marginal ulcers (small white ulcers that appear on the cornea at the limbus) may indicate an allergic reaction to staphylococcal antigen. This is a toxin-related complication of staphylococcal species that frequently cause blepharitis. Pain, photophobia, and a foreign-body sensation are common. The ulcers are sterile and respond to topical steroids.

Giant papillary conjunctivitis resembles vernal disease. This condition occurs mainly in contact lens wearers. These patients develop a syndrome of excessive pruritus, mucous production, and increasing intolerance to contact use. The giant papillae are predominantly on the upper palpebral conjunctiva and can be seen only on lid eversion. Increased deposition may also be seen on the contact lens of the affected eye.

Prehospital transport is rarely indicated for patients with conjunctivitis. More serious concerns may warrant emergency medical services (EMS) transport. Prehospital personnel, emergency physicians, and other medical personnel must be careful not to transmit this infection and should not overlook more serious comorbidity. Thorough hand washing, glove use, and using eye drops in individual or unit dose containers are necessary.

Treatment is often supportive. Artificial tears help the discomfort of keratitis and photophobia. Cold, moist compresses improve the swelling and discomfort of the lids. Antibiotic drops help prevent a secondary bacterial infection. Reserve topical corticosteroids for use by an ophthalmologist when substantial inflammation is present and herpes simplex is excluded.

Broad-spectrum antibiotics, such as Ciloxan (ciprofloxacin) or Ocuflox (ofloxacin), are good choices. Sulfacetamide is also acceptable. Aminoglycoside is toxic to epithelia and retards healing. Polytrim (trimethoprim/sulfamethoxazole) is a reasonable choice particularly in children. Patients with gonorrheal infections, neonates with infections, and patients who are immunocompromised should be admitted for administration of intravenous antibiotics. For treatment guidelines, see the American Academy of Ophthalmology's guidelines [2].

Consult with an ophthalmologist for all serious eye complaints. Simple conjunctivitis usually can be followed up by the patient's primary care provider. Discuss with an ophthalmologist solution to questions or equivocal diagnosis. Neisserial conjunctivitis is an ocular emergency and should be viewed as an ocular finding of systemic disease. Ophthalmologic consultation is essential.

Manage simple conjunctivitis in the ED. Transfer may be appropriate for patients with complications from chronic or gonococcal conjunctivitis when an ophthalmologist is unavailable.

Treatment with antimicrobials and symptomatic therapy is recommended for all patients initially presenting to the emergency department (ED) with simple conjunctivitis. Numerous topical antimicrobial agents may be used, including topical sulfacetamide, erythromycin, gentamicin, ciprofloxacin, or ofloxacin. Avoid neomycin-containing solutions because 8-15% of patients have hypersensitivity reactions. Instill drops every 2 hours. An ointment can be used at night or every 4-6 hours throughout the day.

Consider gonococcal conjunctivitis part of a systemic disease, thus requiring systemic treatment. Inpatient medical regimens include cefoxitin, ceftriaxone, cefotaxime, or spectinomycin. Treat all patients who have chlamydia with tetracycline, doxycycline, azithromycin, or erythromycin. Outpatient therapy is acceptable in less serious cases in which compliance can be ensured and includes intravenous

ceftriaxone (50 mg/kg, not to exceed 1 g) followed by doxycycline 100 mg twice a day or erythromycin 500 mg qid. Identify and treat patients' sexualpartners.

Chlamydial conjunctivitis can be treated with doxycycline 100 mg twice a day for 10 days or azithromycin 1 g. Erythromycin can be used in pregnant patients and infants. Topical therapy with erythromycin also is recommended and may speed resolution. As with gonococcal infections, identify and treat patients' sexual partners.

Ophthalmic antibiotics are used for infectious conjunctivitis. Therapy must cover all likely pathogens in the context of the clinical setting. However, when prescribing the antibiotic, the care provider must take into account that the incidence of methicillin-resistant Staphylococcus aureus (MRSA) has continued to increase in recent years.

The US Food and Drug Administration (FDA) approved a new drug, besifloxacin, for the treatment of bacterial conjunctivitis. [3] Clinical studies showed that patients randomized to besifloxacin ophthalmic suspension 0.6% experienced significantly higher rates of clinical resolution and microbial eradication than patients randomized to vehicle. Besifloxacin was found to be as effective and well tolerated as moxifloxacin ophthalmic solution 0.5% [4]. In addition, a study by Comstock et al. also showed besifloxacin ophthalmic suspension 0.6% to be safe and effective for the treatment of bacterial conjunctivitis [5].

Decongestants generally have vasoconstricting effects with the ability to control pruritus. Mast cell stabilizers inhibit degranulation of sensitized mast cells following exposure to specific antigens and can aid in controlling pruritus for seasonal allergies.

Nonsteroidal anti-inflammatory agents (NSAIDs) are used for the treatment of allergic conjunctivitis. Although most NSAIDs are used primarily for their anti-inflammatory effects, they are also effective analgesics and are useful for the relief of mild to moderate pruritus. Ketorolac 0.4% has also been shown as effective in treating allergic conjunctivitis [6].

Refer patients to their primary care provider for follow-up in 2-3 days to ensure they are responding to treatment. Viral conjunctivitis is usually self-limited to 10-14 days, but symptoms may persist for as many as 6 weeks. Prescribe one of the previously mentioned antibiotics for discharged patients. For copious ocular secretions, patients may use frequent saline irrigation or artificial tears. Avoid eye patching.

Educate the patient regarding careful and frequent hand washing being necessary to reduce transmission from one eye to the other in the patient and from contacts. During birth, risk of transmission of Gonococcus, Streptococcus, or Chlamydia to the fetus exists. Obtain maternal cervical culture results, if indicated and/or available [7].

Risk of chlamydial pneumonia exists. Pneumonia can occur in 10-20% of infants with chlamydial conjunctivitis as many as 6 months later. Untreated chlamydial conjunctivitis in adults can lead to conjunctival scarring. Any of the bacterial organisms that cause conjunctivitis, particularly in a premature infant, can lead to sepsis and death. Neonates are at risk for secondary meningitis, cellulitis, and septicemia, particularly if the conjunctivitis is caused by Escherichia coli, Staphylococcus aureus, or Haemophilus influenzae.

Clinicians should be able to recognize a gonococcal infection in someone with ocular and genitourinary symptoms. Penetration of the cornea can occur within 2 days in patients with untreated Neisseria gonorrhoeae. Infections with N meningitidis may require systemic antibiotics to prevent meningitis. Failure to recognize herpes simplex conjunctivitis and keratitis and prescribing corticosteroids, as well as failure to consider other causes in a patient with an acutely red eye (eg, iritis, uveitis, angle-closure glaucoma, ocular ischemic syndrome, penetrating or perforating ocular injury) are also potential pitfalls [8].

Bacterial conjunctivitis can be contracted directly from infected individuals or can result from abnormal proliferation of the native conjunctival flora. Most causes of conjunctivitis are benign, with a self-limited process; however, depending on the immune status of the patient and the aetiology, conjunctivitis can progress to increasingly severe and sight-threatening infections. Chronic conjunctivitis is usually a source of frustration to both the patient and the ophthalmologist. The role of the emergency physician is to separate the conditions requiring more vigorous treatment and referral from those that can be handled satisfactorily in the emergency department.

Hence based on above findings the present study was planned for Assessment of Different Organism Responsible for Acute Bacterial Conjunctivitis Cases.

Methodology

The present study was planned in Department of Ophthalmology, Patna Medical College & Hospital, Patna, Bihar, India. The study was conducted from December 2018 to February 2019. In the present study 25 cases of the acute conjunctivitis referred to Department of Ophthalmology were enrolled.

A complete external examination of each eye including lids, conjunctiva, cornea, preauricular and submandibular lymph nodes, slit lamp bio-microscopy of the anterior segment, application of Fluorescein to the ocular surface and Schirmer's test where needed. Condition of the lids is noted for any evidence of oedema, blepharitis, mucous crusts, madarosis, tylosis, trichiasis, ectropion, etc. Conjunctiva is examined for evidence of congestion, chemosis, ulceration, petechial haemorrhages, membrane formation, papillae, follicles, nodules, scarring, discoloration etc.

All the patients were informed consents. The aim and the objective of the present study were conveyed to them. Approval of the institutional ethical committee was taken prior to conduct of this study.

Following was the inclusion and exclusion criteria for the present study.

Inclusion Criteria: All cases of acute conjunctivitis with all age groups and of both genders.

Exclusion Criteria: Patients not willing for giving consent. Patients having Ocular trauma, Phlyctenular conjunctivitis, contact lens related red eye and Allergic conjunctivitis.

Results & Discussion

The conjunctiva safeguards the eye against invading microorganisms. Inflammation or infection of the conjunctiva called conjunctivitis. Conjunctiva is a transparent lubricating mucous membrane which covers the bulbar conjunctiva and palpebral conjunctiva. The bulbar portion begins at the edge of the cornea and covers the visible part of the sclera. The palpebral part lines the inside of the eyelids. Conjunctivitis is a prevalent disease all over the world especially higher rate of infection was found in developing countries. Every people at least once in their

lifetime gets affected by conjunctivitis. Conjunctivitis commonly described by red eye which shows symptoms like conjunctival congestion, eyelid edema, irritation in eye with discharge. It may be infectious or non-infectious. Noninfectious conjunctivitis caused by allergens, toxicities and irritants. Infectious conjunctivitis caused by various external factors like bacteria, virus, chlamydial, parasitic and fungi. Among these 80% of conjunctivitis caused by bacteria. Staphylococcus aureus and Pseudomonas aeruginosa are the most prevalent bacteria isolated from human conjunctivitis [9].

Being the foremost part of the eye, the conjunctiva is frequently exposed to foreign bodies and exogenous organisms. Ophthalmologists outpatient practice comprise largely conjunctival infection. Conjunctivitis is a contagious ailment, prevalent worldwide and is the most common form of ocular infection occurring in all age groups. The relative incidence of viral and bacterial conjunctivitis also shows a seasonal variation, with bacterial conjunctivitis predominating in the cold season and viral conjunctivitis occurring in the summer season. The conjunctival cul-de-sac harbours bacteria throughout life, beginning from the time of birth. In addition to exogenous bacteria, the normal flora contributes significantly to the pathogenesis of eye infection. Patients with viral conjunctivitis are often predisposed to bacterial super infection. Purulent or mucopurulent discharge often follows, and this condition may become chronic if not treated in time.

Based on the duration of the signs and symptoms, the bacterial conjunctivitis differs into hyper acute, acute and chronic. Worldwide majority of the cases are found as acute bacterial conjunctivitis. The prevalence of conjunctivitis varies depending on the patient's age and season of the year. Children are widely affected by Staphylococcus aureus, Streptococcus pneumoniae or Haemophilus influenza whereas the elderly people mostly affected by Staphylococcus aureus and Pseudomonas aeruginosa. The bacterial conjunctivitis shown peak occurrence during December-April.

Mahajan VM [10] in his study on acute conjunctivitis, 543 outpatient department cases were examined where majority was Staphylococcus aureus 37.4%, Staphylococcus epidermidis 44.2%, Streptococcus pneumonia 8.75%, Pseudomonas aeruginosa 5.6%, Acinetobacter 2.1%, Coliforms 0.8%, mixed growth 0.8%.

Another study by Gumshi. T [11] conducted among 300 acute conjunctivitis cases showed that staph.aureus 16.5%, klebsiella 8.5%, ps.aerugenosa 3.5%, proteus 1% and st.viridans 1%. After correlating with other studies, it can be safely said that most common causative organism is staphylococcus aureus in acute bacterial conjunctivitis.

Table 1: Demographic Details

Parameters	No. of Cases
Sex	
Males	16
Females	9
Age	
10 – 20 years	2
21 – 30 years	4
31 – 40 years	5
41 – 50 years	4
51 – 60 years	7
61 & above years	3
Socioeconomic Status	
Lower	16
Middle	8
Higher	1
Education	
Illiterate	5
Literate	20
Total	25

Table 2: Eyes Involvement

Parameters	No. of Cases
Left Eyes	5
Right Eyes	12
Both Eyes	8
Total	25

Table 3: Gram Positive & Gram-Negative Cases

Parameters	Gram Positive	Gram Negative
Left Eyes	2	3
Right Eyes	3	9
Both Eyes	2	6
Total	7	18

Table 4: Causative Organism

Parameters	No. of Cases
Staphylococcus aureus	16
Streptococcus pnemoniae	5
Haemophilus influenzae	2
Staphylococcus epididymis	2
Total	25

Table 5: Signs

Parameters	No. of Cases
Lid Edema	23
Matting eyelashes	6
Conjunctival congestion	25
Conjunctival chemosis	2
Petechial Hemorrhage	13
Conjunctival follicles	12
Conjunctival papillae	5
Pseudomembrane	0
Corneal sensation	24
Preauricular lymphadenopathy	6

Rose in 2007 systemically reviewed the literature on all aspects of the management of acute infective conjunctivitis undertaken. Acute infective conjunctivitis is a common presentation in primary healthcare. It is usually a mild condition and serious complications are rare. Clinical signs are a poor discriminator of bacterial and viral causes. Studies of treatment show that there is a high rate of clinical cure without any treatment. Treatment with topical antibiotics improves the rate of clinical recovery and this is more marked in the first 2-5 days after presentation, but less by 6-10 days. Studies comparing treatment with different antibiotics do not demonstrate that any one antibiotic is superior; the choice of antibiotic should be based on consideration of cost and bacterial resistance [12].

Rietveld et al. measured the age-specific incidence of infectious conjunctivitis, described its management by Dutch general practitioners, and then compared these findings with the recommendations made in the guideline. They evaluated data from all patient contacts with 195 general practitioners from electronic medical records. They concluded that the management of infectious conjunctivitis by Dutch general practitioners was not in accordance with the recommendations of the consensus-based guideline published five years previously, despite its wide distribution [13]. Bhat N et al. conducted a questionnaire survey to assess the knowledge and prevalence of bacterial conjunctivitis among the dentist. They concluded that eye flu being an occupational hazard among dentists, personal ophthalmic prophylactic care is a must which helps in prevention of spread of infection to other patients and family members. [14].

Choice of antimicrobial drugs for conjunctivitis is limited by their availability for topical application. Sharma S has enlisted the drugs available for this purpose: fluoroquinolones, aminoglycosides, penicillins, chloramphenicol, tetracyclines and erythromycin/ azithromycin [15] Fluoroquinolones are the most common topical antibiotics used in bacterial conjunctivitis [16], but there are studies suggesting development of resistance against second generation fluoroquinolones like ciprofloxacin and ofloxacin 5, 8; therefore, the newer generation fluoroquinolones such as moxifloxacin and gatifloxacin were also tested for, along with ciprofloxacin and ofloxacin.

The standard of care for conjunctivitis, regardless of causative agent, continues to be antibiotics prescribed empirically. Topical antibiotics reduces the time of bacterial conjunctivitis, decrease transmissibility and quicken recovery while allowing earlier return to school or work. 7 The emergence of antibiotic resistant strains has made it imperative for the practitioner to be familiar with the clinical spectrum of conjunctivitis, the microbial agents responsible for it and the antimicrobial agents to combat it. Conjunctivitis with adequate treatment usually heals completely. Rarely complications like corneal marginal infiltrates, ulcers and cicatricial involvement of the lids, eyelashes and lacrimal passage may contribute to the morbidity and probable blindness. It is important to differentiate conjunctivitis from other sight-threatening eye diseases that have similar clinical presentation and to make appropriate decisions about further testing, treatment, or referral. An algorithmic approach using a focused ocular history along with a penlight eye examination may be helpful in diagnosis and treatment. Because conjunctivitis and many other ocular diseases can present as “red eye,” the differential diagnosis of red eye and knowledge about the typical features of each disease in this category are important [17, 20].

Topical antibiotics are commonly prescribed in all cases of red eye; with the possibility of inappropriate treatment of viral conjunctivitis. This raises concerns of antibiotic resistance, costs and complications due to ocular or systemic antibiotic use. Moreover, use of topical antibiotics in all cases of red eye may result in delayed diagnosis of other non-infective conditions resembling conjunctivitis, such as iritis and acute angle closure glaucoma. Visscher KL et al.. suggest that even if antibiotics are being prescribed to cover the bacterial causes, it becomes essential to consider whether antibiotics are even necessary for the resolution of bacterial conjunctivitis. They have also suggested that antibiotics may be prescribed after a delayed period, if symptoms do not improve within 3 days of onset, or not at all [21].

Conclusion

The data generated from the present study concludes that acute conjunctivitis is the common problem seen worldwide. It is generally seen in the patients with low socioeconomic status. Prevention of any disease is better than cure which happens to be very true especially regarding to acute conjunctivitis. Staphylococcus aureus, Streptococcus pneumonae, Hemophilus influenzae and Staphylococcus epididymis were most common bacteria seen in our study.

References

1. Meltzer JA, Kunkov S, Crain EF. Identifying children at low risk for bacterial conjunctivitis. Arch Pediatr Adolesc Med. 2010; 164(3):263-7.
2. [Guideline] American Academy of Ophthalmology Cornea/External Disease Panel. San Francisco, Calif. Preferred Practice Pattern Guidelines. Conjunctivitis,

2008.
3. US Food and Drug Administration. FDA News Release: FDA approves besivance to treat bacterial conjunctivitis. May 28, 2009.
4. Bertino JS, Zhang JZ. Besifloxacin, a new ophthalmic fluoroquinolone for the treatment of bacterial conjunctivitis. Expert Opin Pharmacother. 2009; 10(15):2545-54.
5. Comstock TL, Paterno MR, Usner DW, Pichichero ME. Efficacy and safety of besifloxacin ophthalmic suspension 0.6% in children and adolescents with bacterial conjunctivitis: a post hoc, subgroup analysis of three randomized, double-masked, parallel-group, multicenter clinical trials. Paediatr Drugs. 2010; 12(2):105-12
6. Schechter BA. Ketorolac tromethamine 0.4% as a treatment for allergic conjuctivitis. Expert Opin Drug Metab Toxicol. 2008; 4(4):507-11.
7. Abelson MB, Heller W, Shapiro AM, Si E, Hsu P, Bowman LM, et al.. Clinical Cure of Bacterial Conjunctivitis with Azithromycin 1%: Vehicle-Controlled, Double-Masked Clinical Trial. Am J Ophthalmol, 2008.
8. Cochereau I, Meddeb-Ouertani A, Khairallah M, Amraoui A, Zaghloul K, Pop M, et al.. 3-day treatment with azithromycin 1.5% eye drops versus 7-day treatment with tobramycin 0.3% for purulent bacterial conjunctivitis: multicentre, randomised and controlled trial in adults and children. Br J Ophthalmol. 2007; 91(4):465-9.
9. Silverstein J1, Grand D, Kawatu D, Shah SA, Steinkeler J, LeLeiko N, et al.. Feasibility of using MR enterography for the assessment of terminal ileitis and inflammatory activity in children with Crohn disease., J Pediatr Gastroenterol Nutr. 2012; 55(2):173-7. doi: 10.1097/MPG.0b013e318249595d.
10. Mahajan VM. Acute bacterial infections of the eye: their etiology and treatment. Br J Ophthalmol. 1983; 67(3):191-4.
11. Gumshi T. Bacteriological study of acute conjunctivitis [Thesis]. Imphal, Manipur University, 1994.
12. Rose P, Management strategies for acute infective conjunctivitis in primary care: a systematic review., Expert Opin Pharmacother. 2007; 8(12):1903-21.
13. Rietveld RP, ter Riet G, Bindels PJ, Schellevis FG, van Weert HC. Do general practitioners adhere to the guideline on infectious conjunctivitis? Results of the Second Dutch National Survey of General Practice. BMC Fam Pract, 2007, 8:54.
14. Bhat N, Patel R, Reddy JJ, Singh S, Sharma A, Multani S, et al.. Knowledge and Awareness of Eye Flu among the Dentists and Dental Auxiliaries of Udaipur City, Rajasthan. Int J Prev Med. 2014; 5:920-3.
15. Sharma S. Antibiotic resistance in ocular bacterial pathogens. Indian J Med Microbiol. 2011; 29(3):218-22.
16. Sharma S. Antibiotic resistance in ocular bacterial pathogens. Indian J Med Microbiol 2011; 29(3):218-22.
17. Smith AF, Waycaster C. Estimate of the direct and indirect annual cost of bacterial conjunctivitis in the United States. BMC Ophthalmol. 2009; 9:13-20.
18. Høvding G. Acute bacterial conjunctivitis. Acta Ophthalmol. 2008; 86:5-17.
19. Mannis MJ, Plotnik RD. Bacterial conjunctivitis. In: Tasman W, Jaeger EA, editors. Duanes Ophthalmology on CD-ROM. Lippincott Williams and Wilkins, 2006.
20. Amir A Azari, Neal P Barney. Conjunctivitis. A Systematic Review of Diagnosis and Treatment. JAMA. 2013; 310:1721-1729.
21. Visscher KL, Hutnik CML, Thomas M. Evidencebased treatment of acute infective conjunctivitis Breaking the cycle of antibiotic prescribing. Can Fam Physician. 2009; 55(11):1071-75.