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Eye Diseases Transmitted By Insects To Humans

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Abstract
Microorganisms can affect ocular causing infections, most common eye infections are due to bacteria while fugal, viral and parasitic infection are less than bacteria. Most familiar symptoms to the eyes infections are pinky eye, pain, tears, itchy, and in general the inflammation affected the external part of the eye, however there are some infectious diseases that may affect other part of the eye but they are very rare. It is important to study the infection pathologically, morphologically, and molecular biology using the most advanced techniques to identify the infection and prescribe the optimal treatment. In the current brief review article the author went through the main microorganisms that causes ocular infections particularly; bacteria, viruses, fungal, and parasites, and describe the main symptoms and the microorganism that cause the infection and which part of the eye is affected.

Keywords: Insects, Ocular infection, Microorganism, Bacteria, Fungal, viral, Parasites.

Introduction

The infection of eyes is very common due to invade of fungi, parasites, bacteria, and viruses, theses microbes are able to attach the interior and the surface of the eye causing problems that can affect the eyes causing; corneal ulcer, conjunctivitis, red eye, however, and in order to get better understanding to the diseases that affect the eye, it is important to have an idea about the most common eye diseases that caused due to eye infection. However, the infection could take long time to be treated and painful and very dangerous and need a special attention and medical care, also eye infection can transmitted from patient to other [(1, 2, 3)].

The eye of human has a structure that considered as not symmetrical (asymmetric) and has exceptional defense system and because eye is exposed to surrounding environment it can affected with microbes (microbiota) that lives with us everywhere, some of these microbiota could be combined and associated to the pathogen of the eye and leads to a very bad complications and consequences that may affect the vision [(4, 5)].

In the current review, the eye infection will be classified firstly according to the microorganism causes such as bacterial, viral, fungal and parasites.

1-Bacterial infections:

Most of the common eye infections are caused by bacteria that represent a very high proportion from other microbes and in accordance with the estimation of WHO, most of eye infections and the weakness in eye are exists in the population of low income regions (around 90% of the individuals) [7, 8].

Eye lid infection is usually named as EOIs (External Ocular Infections) which is affected the external part of the eye particularly cornea and conjunctiva, and the most frequent conjunctiva are canaliculitis, dacryocystitis, keratitis and blerpharitis [9, 10] which ultimately increase the blindness and morbidity [11, 12]. Gram negative and gram positive bacteria are the main causes of the eye infection and the most common bacteria that cause ocular infections are; **Haemophilus influenzae** , **Morraxella** spp, **Neisseria gonorrhoeae, Enterobacteriaceae, Pseudomonas aeruginosa (P. aeruginosa), Bacillus, Streptococcus pneumoniae (S. pneumoniae), and Staphylococcus aureus (S. aureus)** [13].

In 2015, and 2017 Amsalu et al [14]., and Teweldemedhin et al [15]., respectively mentioned in their studies that in Ethiopia around 62% of eye patient (EOIs) were confirmed as bacterial infection, and they find that if these infections were not treated and followed up by specialists it may eventually caused a serious damages to the ocular structure and will leads to blindness /or visual impairments, also they reported that the percent of blindness prevalence which related to microbial infection is 1.60% . Bacteria can infect the eye as a poly/or mono microbial inflammation that may associated with other reasons such as previous ocular infections, chronic nasolacrimal duct obstruction, dry eye state, age, surgery, trauma, and contact lenses [16, 17, 18].

- **Gram positive bacteria:**

Previous studies that were carried out on eye infection that were caused due to Gram positive bacteria shows that the most common one is Staphylococci which inter in most of eye inflammation and mainly these bacteria Staphylococci and Coagulase Negative Staphylococci (CoNS) are the main causes of keratitis, conjunctivitis and blepharitis diseases [19, 20].

Orlans et al., 2011 [21] reported that in spite of the common CoNS existing, these bacteria are considered as the main reason of eye infections and there frequency rate are increasing over time all over the world, these findings were agreed with Baghani et al., 2013 [22], they did their study for more than five years in Iran for the period from 2005 until 2006, their findings shows that 40% of eye infections in Iran were because of CoNS. Other study was carried out in India in 2010 by Reddy et al.,[23], they found that more than 45% of eye infections were by reason of CoNS, however a previous study carried out by Ansari et al., 2008 [24] they found that the bacterial infection will be worse in patients who did cataract surgery, the percentage of isolates CoNS was raise up to around 89%, same finding was that the patients had **S. aureus** and CoNS isolates, and the common species in CoNS were **S. saprophyticus** and **S. epidermidis (gram positive bacteria)** [25].

- **Gram negative bacteria :**

Many studies were carried out all over the world indicate that gram negative bacteria were isolated from eye infections and the most frequent are Neisseria gonorrhoeae, Moraxella spp, Proteus spp, Citrobacter koseri, Enterobacter spp, Escherichia coli, and Pseudomonas aeruginosa [26, 27].

The existence of the bacteria is related with disease, for instance, patients suffer from dacryocystitis, the most common bacteria present and accompanied with it are Haemophilus influenza, **Klebsiella pneumonia, Enterobacter, and Pseudomonas** spp. [28], while in 2013, Amin et al., reported that in Egypt, **Acinetobacter lwoifi** and E coli were isolated from the same disease (dacryocystitis) [29]. However, it was reported that in the diagnosis of keratitis the common bacteria are; **H. influenza, M. catarrhalis**, **P. multocida**, **P. mirabilis**, **Enterobactor** spp, **Fusobacterium, S. liquefaciens, S. marcescens, Acinetobactor, K. pneumonia, E. coli and P. auroginosa** [30, 31].

Additionally, the species of **Propiolactone had been noticed higher in** endophthalmitis patients (around 52%) [32], also, and unpredictably, Jayasudha et al., 2014 noticed endogenous, post-traumatic, and post-operative in polymicrobial

infection of endophthalmitis and there isolates contains **Haemophilus spp, Acinetobacter, Enterobacter, K. pneumonia, P. aeruginosa and** Serratia spp, and moreover 2 gram positive bacteria **Massilia** spp., and **Pantoea** spp [33]. When these microorganisms infected the eye it may cause a very bad damage to cornea like other dangerous pathogens and must consider as one of the most important and main eye threats [34].

In India it was noticed that **M. lacunata** (64%) and **M. catarrhalis** (53%) infection were considerably upper in the diagnosis of dacryocystitis and blephratis [35].

2- Viral eye infections :

Many viruses can cause eye infection, normally both eyes involved, but it could be at different time, however, viral conjunctivitis is the most common eye infection that caused by virus [36, 37].

In general, there are a certain symptoms that may link and associated with eye infection caused by virus, among them are [38, 39, 40]:

The symptoms don't go out by using antibiotic drops; however it may be less after more than one day, Irritation in most of the eye tissues, particularly in the lids, The vision is distorted (blurred vision),Eyes become high sensitive to light (photophobia),Moist and tearing eyes, Irritated (like some foreign or strange object in the eye),Pinky or red eyes (this symptom is common to all eye infection), Eyes suffer from symptoms like burn and pain, Swollen eyes, Other viral infection symptoms such as; cold, runny nose, sore throat, Engorgement in the blood vessels of the eyes.

Many viruses that can cause eye infection, however, the most common viruses that cause viral conjunctivitis are; Enterovirus 70, A24, Rubeola virus, Rubella virus, Herpesviruses (Epstein-Barr virus),Varicella-zoster virus, Herpes simplex virus. [41, 42, 43] .

As it was reported by Devilliers et al., 2021 [42], the viral infection may affect all the tissues in the eye, and it may have long or short term of effect, also it may have a very bad, medium or light consequences, for instance, herpesviruses are mostly the common and frequent one for kerato-uveitis, and keratitis, and this virus is the main cause of blindness because it causes opacification to corneal as depicted by Weber and Eichenbaum 1997 [44].

In 2022, Ryder and Benson [45] reported in their etiology study to conjunctivitis that it may result from parasites, fungi, bacteria, and viruses, however the last one (viruses) are the most common cause to this infection (around 80% are viral infection), and Adenovirus is the most frequent pathogen, and around 78% of the cases are viral infection as reported by in 2013 by Azari and Barney [46] whose also found that there are other viral pathogens may cause conjunctivitis such as Enterovirus, Herpes zoster and Herpes simplex [45, 46].

3- Fungal eye infections:

It is very rare for eyes to get infected with fungi; however fungal eye infection may happen as consequences of eye injury, especially when the injury was caused by thorn or stick (plant material), such fungi that live in plant is **Fusarium** that inflamed the cornea causing infection in the interior parts of the eyes such as (endophthalmitis) [47].

Below are some of fungus and the infectious diseases that they cause to eyes:

Table 1: Correlation between fungus and eye disease

Name and location of ocular infections	Fungus	Reference No.
Sino-orbital disease	***Aspergillus***	**48**
Optic neuropathy	**Cryptococcus**	**49**
	Histoplasma	**50**
	Zygomycetes	**51**
Endogenous endophthalmitis	**Bipolaris**	**52**
	Fusarium	**47**
	Aspergillus	**53**
Cornea	**Candida**	**54**
Colonization of the conjunctiva	**Pneumocystis**	**55**

Stephen *et al*., 2000 [56], report that the most common causes of fungal infection to the eye are Candida spp., which cause endophthalmitis and endogenous in spite of the primary infection with dimorphic fungi that may leads to chorioretina, they also mentioned that contact lenses may cause keratitis that may caused by Acanthamoebae spp., filamentous fungi and yeasts [56].
Thomas 2003 [57], reported that cornea fungal infection is very important because it may leads to eye morbidity mostly in agricultural environment all over the world, he also mentioned that in spite of the advance techniques used in diagnosis and the new medications used in eye fungal treatment, still around 20% of the patients required surgical operations, this finding was also previously found by Vemuganti et al., 2002 [58].

Ayse and Sengul 2011 [59], reported that there are three fungal species that are the main causes of most of the eye infections and these are Candida, Aspergillus, and Fusarium, their findings were from wide lab experiments and investigations, they also mentioned that there are new approaches for presumptive diagnosis such as molecular method or serological, and they recommend the investigation must involved with immunology, genetics, cell biology and pathophysiology [59].

Bourcier et al., 2017 [60] reported that keratomycoses and keratitis infections must be considered as topical corticosteroids, chronic ocular surface disease, prior corneal surgery, and corneal trauma that involved yeasts or filamentous fungi. These findings were also confirmed by Mahmoudi et al., 2018 [61].

Arunga et al., 2021 [62] study the eye fungal infections on patients their ages were from 27 to 73 years, the study was carried out in Uganda, the researchers used new medication (eye drops) and applied the new eye drops (chlorhexidine 0.2%) on a wide number of patients that have fungal eye infections, their trials took 15 months, they isolate *Acremoninum* spp, *Bipolaris* spp, *Candida* spp *Fusarium* spp at the end of their experiments 75% of the patients were completely healed [62].

Liang et al., 2021 [63] another study was made to prepare a certain solid lipid nano particles (SLNPs) and synthesize emulsion solutions and used it as eye drop against eye fungal infections [63].

4-Parasite eye infections :

Before proceeding with parasite eye infection, it is important to submit a brief about parasites, they are microorganisms that live on other organs called host, however, mainly, and there are three types**; Ectoparasites., Helminths., and Protozoa** [64]. If parasite infected the eye it will cause a lot of complications such as immunological, mechanicals and allergic. Generally, it is difficult for the ophthalmologist to identify the parasitic eye infection, however there is a new molecular techniques used in diagnosis of ocular parasitic infection [65].

The most important ophthalmic diseases that are due to parasitic infections among them are Ocular toxocariasis, Ocular toxoplasmosis, Loiasis ,Onchocerciasis (river blindness), Gnathostomiasis, Acanthamoeba keratitis, Ocular toxoplasmosis, Demodex folliculorum. [66, 67] .

These pathologic ocular diseases increased recently due to the uses of immunosuppressants [68, 69].

Pahuja et al., 2013 [70] study the external eye infections that caused by parasites, they reported that parasitic ocular infections are very rare, and if it happened, this type of infections need an active screening procedures and measurements to diagnose and then start the therapy, the most important parasites that causes external eye diseases are; Leishmania, cestodes (tapeworms), nematodes (roundworms) [67].

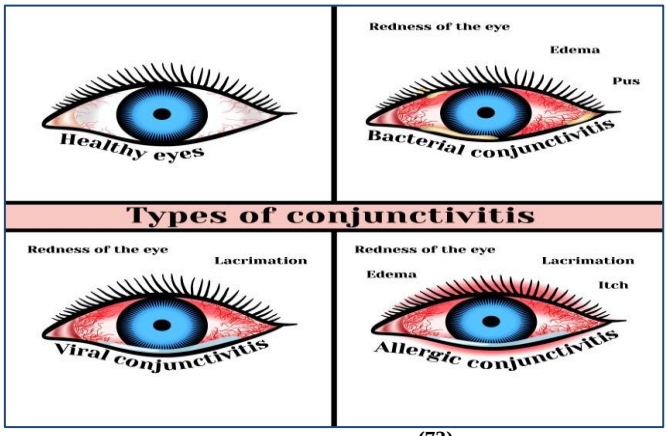
Das et al., 2016 [71], their study was carried out in India and they reported that ocular parasitic diseases are due to trematodes and Cystoidea, however, they encourage researchers to study the pathology, morphology and molecular biology to the parasite before starting treatment [71].

Izadi et al., 2018 [72], focus in their study at the infections that can occur during travel, in their finding they mentioned that the international traveling may rise the parasitic ocular infections which affected by the geographical areas, habits of the nations, environment, food and much more [72].

In general eye infection is painful and dangerous and may transmitted between people if it is not treated well, some of ocular disease are easy treated while others need a very special care and attention and the most common symptoms are;

blemishes around the eye, swelling, redness, pain, itchy.

There six most common diseases that may affect the ocular; Conjunctivitis (Pink Eye), Corneal Bacterial Infections: Staph and Strep, Styes (due to eyelash hair follicle), Blepharitis, Corneal Ulcer, Allergies and Hay Fever



Eye Infections [73]

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