A tiny tick can cause a big health problem

Manuel John[1,2], M Raman[3], Keith Ryan[4]

Ticks are tiny crawling bugs in the spider family that feed by sucking blood from animals. They are second only to mosquitoes as vectors of human disease, both infectious and toxic. Infected ticks spread over a hundred diseases, some of which are fatal if undetected. They spread the spirochete (which multiplies in the insect's gut) with a subsequent bite to the next host. We describe the only reported cases of peri ocular tick bite from India that presented to us within a span of 3 days and its management. Due suspicion and magnification of the lesions revealed the ticks which otherwise masqueraded as small skin tags/moles on gross examination. The ticks were firmly latched on to the skin and careful removal prevented incarceration of the mouth parts. Rickettsial diseases that were believed to have disappeared from India are reemerging and their presence has recently been documented in at least 11 states in the country. Among vector borne diseases, the most common, Lyme disease, also known as the great mimicker, can present with rheumatoid arthritis, fibromyalgia, depression, attention deficit hyperactivity disorder, multiple sclerosis, chronic fatigue syndrome, cardiac manifestations, encephalitis, and mental illness, to name some of the many associations. Common ocular symptoms and signs include conjunctivitis, keratitis, uveitis, and retinitis. Early detection and treatment of tick borne diseases is important to prevent multi system complications that can develop later in life.

Key words: *Amblyomma*, Ixodidae, Lyme disease, tick, zoonosis

Videos Available on: www.ijo.in

Access this article online

Quick Response Code:

Website: www.ijo.in

DOI: 10.4103/ijo.IJO_411_17

[1]Professor of Ophthalmology, Al Azhar Medical College, Thodupuzha, [2]Consulatant MGDM Hospital, Kangazha and LLM Hospital, Kidangoor, Kottayam, Kerala, India, [3]Professor of Parasitology, Madras Veterinary College, Tamil Nadu Veterinary and Animal Sciences University (TANUVAS), Chennai, India, [4]Former Professor, Electron Microscopy Centre, Plymouth University, England, United Kingdom

Correspondence to: Dr. Manuel John, Department of Ophthalmology, Marian Medical Centre, Pala, Kottayam, Kerala, India. E-mail: drtjm@yahoo.com

Manuscript received: 21.05.16; Revision accepted: 14.07.17

A zoonosis is an infectious disease that is transmitted between species, at times by a vector, from animals to humans or from humans to other animals. The latter is sometimes called reverse zoonosis or anthroponosis. The major factor contributing to the appearance of new zoonotic pathogens in human populations is increased contact between humans and wildlife.[1] This can be caused either by encroachment of human activity into forest zones or movement of wild animals into areas of human activity. Though very commonly reported from the temperate regions of the world, the incidence has increased worldwide due to increasing travel and changing habitats of the vector.

Of the vector-borne illnesses in the United States, tick-borne diseases are the most common.[2] Few cases have been reported from the Indian subcontinent.[3] Ticks can carry and transmit a remarkable array of pathogens, including bacteria, spirochetes, rickettsiae, protozoa, viruses, nematodes, and toxins. They have three life stages: larvae, nymph, and adult stages. The development of ticks depends on a series of moults, especially in the nymph developmental stage. Each blood meal helps them move onto the next stage of their life cycle. A single bite can also transmit multiple pathogens, a phenomenon that has led to atypical presentations of some classic tick-borne diseases. We report two cases of tick bite near the eye and their management.

Case Report

Two patients, the first a sixty plus female from the lower socioeconomic group, staying at a retirement home, presented to us in January with a history of pain, itching, and swelling near the left eye over the lacrimal sac area since the week before. The irritation increased gradually till she noticed a red patch with a nodule which she assumed to be a small mole. Torch light examination revealed what appeared to be a small skin tag with surrounding crusting. Close-ups appeared similar: a nodule with additional erythema. It was only under the microscope at ×6 and ×10 that the surprise was revealed – a

Cite this article as: John M, Raman M, Ryan K. A tiny tick can cause a big health problem. Indian J Ophthalmol 2017;65:1228-32.

swollen Ixodid firmly attached to the skin with its mouth parts surrounded by disc-shaped pellets of excreted blood [Video 1].

The second patient, a 4-year-old boy, presented with a similar history at another hospital 15 km from the first [Video 2]. Clinical examination revealed a skin colored nodule attached to the upper lid margin with surrounding excoriation [Fig 1. left]. The child had repeatedly scratched the swelling to no avail. The parents panicked on seeing blood stains and rushed him to us about 3 days after the onset of symptoms. Examination under the microscope at ×10 revealed that the tick had firmly attached, buried in the lash hair on the lid margin. When the underside of the tick was exposed at the site of bite, stacked up discs of semisolid blood were seen emanating from the anal orifice of the tick [Video 2]. The rest of the ocular examination was unremarkable.

The ticks were removed carefully using fine forceps [Video 1] and sent to Madras Veterinary College for identification. They belonged to the family Ixodidae, the genus in these cases was *Amblyomma*. Identification is done by observing the anal groove which arches in front of the anus. This is only seen in the genus Ixodidae [Fig. 2].

Both these patients were followed up, the woman for 3 years and the child for a year. Routine blood and serologic tests were within their normal ranges. The woman developed pain, induration, focal edema, and local lymph nodes [Fig 1, right] 5 days after tick removal. This responded to tablet cefpodoxime 200 mg bd, tablet ranitidine 150 mg bd, tablet diclofenac 50 mg bd, tablet metronidazole 400 mg tid, and tablet pheniramine maleate 25 mg bd administered for 5 days. For the 4-year-old child, recovery was uneventful. Neither of them developed either systemic or ocular complications.

Discussion

The majority of pathogen species causing disease in humans are zoonotic. Zoonotic species are overall twice as likely to be associated with emerging disease compared to their nonzoonotic counterparts.[4] With more than 800 species of these obligate blood-sucking ticks inhabiting the planet, they are second only to mosquitoes as vectors of human disease, both infectious and toxic.

Ticks prefer a humid environment. In hot, dry weather, they are less active. Adult ticks climb up tall grass and bushes on the edge of trails to wait for an animal to pass by, to which they can attach themselves and feed. From the perspective of disease transmission to humans, the essential characteristic of ticks is their need to ingest a blood meal to transform to their next stage of development. Being opportunistic in their eating habits, they take their requisite blood meal from all classes of vertebrates (e.g., mammals, reptiles, and birds), with the exception of fish.[5]

Broadly, ticks are classified into two major categories – soft ticks and hard ticks. Ticks having tough, leathery skin are known as soft ticks. Caves and nests are their favorite dwelling places. Soft ticks live on bats, birds, and ground-nesting animals. In soft ticks, the mouth parts are not visible from above unlike in hard ticks. Hard ticks also have in addition a hard chitinous coat or shield called the scutum on their dorsal surface. This is seen as a dark brown structure near the mouth and is absent in soft ticks [Video 1]. It is very easy to distinguish between the sexes in ticks as females are blood suckers, while in male ticks, the dorsal aspects covered by the scutum restrict their feeding. The scutum is seen covering 1/8th or lesser of the body surface in females, allowing them to suck in a lot of blood and thereby become swollen [Video 2].

Once on a host, the tick inserts its hypostome, a central piercing element which has hooks/reverse barbs [Fig. 3], into the host's skin. This anchors the tick to its host. Some ticks secrete a cementing material to fasten themselves to the host. In addition, Ixodes ticks secrete anticoagulant, immunosuppressive, and anti-inflammatory substances into the area of the tick bite. These substances presumably help the tick to obtain a blood meal without the host's noticing [Video 1]. The same substances also help any freeloading pathogens establish a foothold in the host.[5] The sudden appearance of two patients with similar infestation has been linked to warmer weather which increases aggressiveness in ticks and augments their attacks on humans.[6]

The difficulty of removing attached ticks is due to the barbed hypostome present in the head that engages extremely tightly with tissue [Fig. 3]. The so-called "head" of a tick includes structures involved in feeding, together known as the "capitulum." It consists of a pair of leg-like sensory structures known as "palps" that enable the tick to detect an approaching

Figure 1: Focal edema and induration

host, a pair of knife-like structures known as "chelicerae" that cut an opening in the host skin, and a single barbed structure known as a "hypostome" that enters this opening [Fig. 3]. The hypostome anchors in the host flesh only after the chelicerae cut open the skin, thereby allowing the tick to take a blood meal. The dorsal view of the hypostomal region shows the cheliceral sheathes and chelicerae, which are seen superiolaterally [Fig. 4].

Two methods of tick removal are commonly followed. In the first method, the tick is held with fine forceps/tweezers and using steady, even pressure, pulled outward [Video 1]. Twisting or jerking can cause the tick's mouth parts to break off. The bite site is then cleaned with iodine/alcohol.[7]

Another method of tick removal is to inject a wheal of lignocaine with epinephrine intradermally beneath the tick. By blanching the area and thereby removing the blood, the tick may be induced to release on its own accord. This method seems intuitively feasible, but it has not been tested in any large clinical trials.[5]

Reducing the chance of tick bite is of paramount importance. It is suggested that humans should avoid tick-infested areas, such as leaf litter under trees, avoid brushing against long grasses and brush on the edges of paths, not sit on stumps or fallen logs, wear light-colored long pants and long sleeves so that ticks can be easily seen, tuck the shirt into pants and tuck pants into socks, to use N, N-diethyl-meta-toluamide on the skin and treat clothing with spray containing permethrin, do a thorough tick check upon coming inside and for several days following exposure, check bedding for ticks that drop off, and take the help of a veterinarian for protection of pets and domestic animals.[7]

Lyme disease (with its ocular manifestations) is a worldwide disorder that is rapidly increasing in frequency. It is transmitted through tick bite and is a treatable multisystem disease that presents in three stages of severity. The first stage lasts between 1 and 4 weeks, duly followed by the second stage lasting 1–4 months. The third stage can last from months to years. There are various ocular symptoms of Lyme disease, including pain, visual impairment, photophobia, myodesopsia, diplopia, and lack of accommodation.[8] The site of inoculation could be any part of the body. Skin manifestations are the earliest to occur, and diagnosing these lesions, followed by appropriate treatment, can prevent complications of the disease, which are mainly neurological.[3] Erythema migrans on the skin is seen in 70%–80% of patients [Fig. 5]. The typical erythema migrans rash of Lyme disease is almost always a solid, blanching, erythematous patch, rather than the bull's eye appearance. This usually lasts for around 3–5 weeks but can also be as brief as a single day before dissipating. This can make it difficult to notice in some patients, and symptoms such as joint aches and tiredness may simply be attributed to a strenuous hike, meaning Lyme disease has an opportunity to disseminate before being diagnosed and treated.

In some instances, the spirochete may produce a necrotic lesion similar to the eschar described in rickettsial infections (e.g., African tick fever). However, only the bull's eye pattern is pathognomonic[9] [Fig. 5]. Ocular involvement, though possible at every stage, is most frequently seen in the later (second and third stages) stages of Lyme disease. This can present with unusual forms of conjunctivitis, keratitis, cranial nerve palsies, optic nerve disease, uveitis, vitritis, and other forms of posterior segment inflammatory disease.

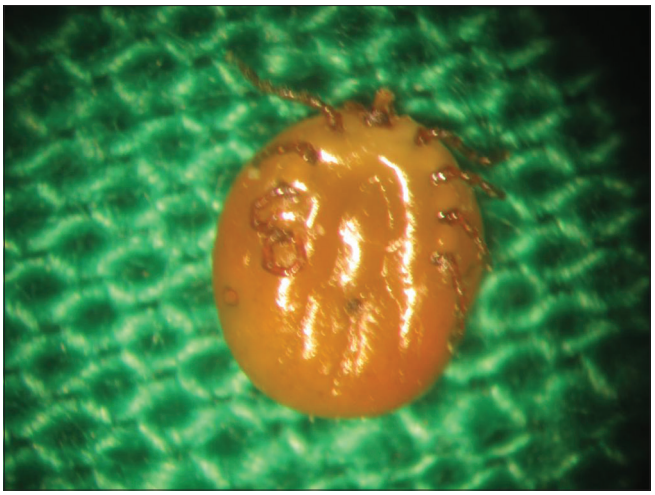

Figure 2: Anal groove arching in front of the anus. The head and legs are at the top of the image

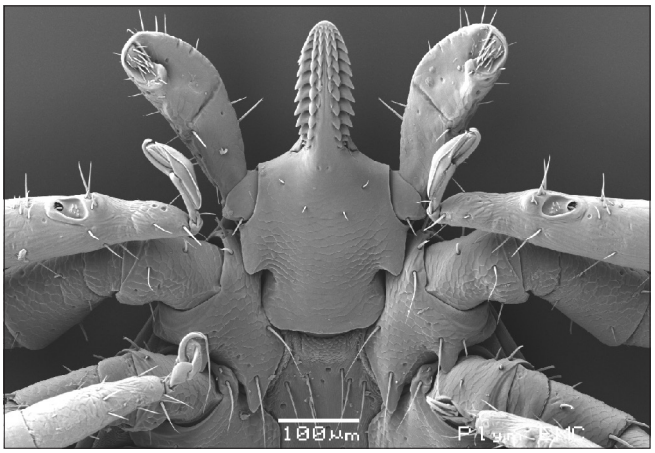

Figure 3: Ventral view of hypostome, palps and first two pairs of legs

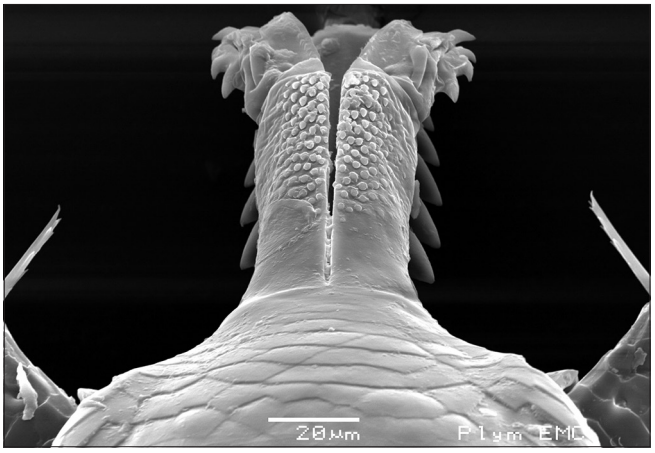

Figure 4: Dorsal view of the chelicerae protruding from their sheath

Follicular conjunctivitis, often self-limited, is associated with an influenza-like symptom in the first stage of the disease. Keratitis, which can be focal or disseminated, is characteristic of the second and third stages and may either be "interstitial" or "ulcerative" with peripheral neovascularization. Episcleritis

Figure 5: Erythema migrans on the skin and the pathognomonic bull's eye

and scleritis are rare and seen in the late phase.[10] Anterior uveitis is infrequent and granulomatous. Intermediate uveitis is the most common of the uveitis and is associated with pars planitis. Posterior uveitis signs mostly include chorioretinal involvement.[10] Panuveitis can however result in irreversible visual loss.

Macular edema and vasculitis are the most frequent retinal findings occasionally complicated by vitreoretinal proliferation. They have been described either during the erythema migrans phase or in neuroborreliosis. Venular occlusions and chorio-retinal inflammatory foci are less common manifestations. Multifocal choroiditis without vitreous involvement with a picture of acute posterior multifocal placoid pigment epitheliopathy (APMPPE) that was serologically positive for Lyme disease resolved with a 2-week intravenous course of ceftriaxone in one patient [Fig. 6].[11]

A recent report has also shown cotton wool spots as another possible sign of Lyme retinitis.[12] Neuro-ophthalmological alterations represent an early evidence of neuroborreliosis. Diplopia and visual impairment, with or without meningitis, are the suggestive signs. In the case of optic neuritis, the concomitant presence of cranial nerve palsies is expected (mostly VI or VII). Papillitis as the sole ocular sign in Lyme disease has also been reported from the UK [Fig. 7].[13] Uncertain reports of orbital myositis and Jarisch–Herxheimer reaction have also been proposed as a consequence of borreliosis.[10] A patient with any of these manifestations should be questioned about exposure to an area endemic for Lyme disease, tick bites, skin rash, or arthritis. Such patients should undergo serological testing.

If the clinical presentation is suggestive of Lyme disease, a course of oral antibiotics should be used (unless the patient gives a history of adequate therapy). These antibiotics usually include doxycycline for adults and children older than eight,

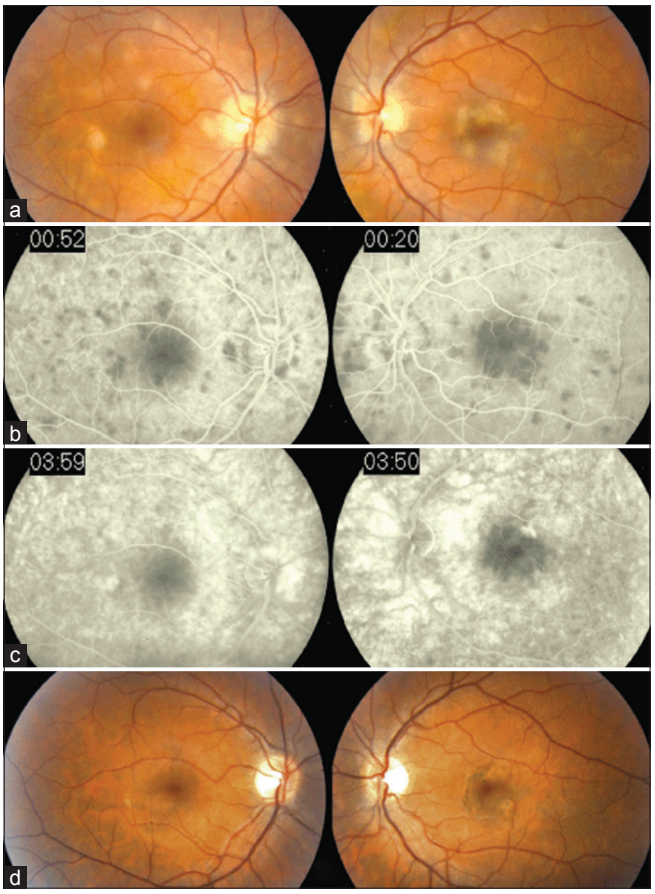

Figure 6: In this patient, fundoscopic photos showing multifocal yellowish-white placoid lesions located in the posterior poles of both eyes, more in the left eye, at the level of retinal pigment epithelium (a). Fluorescein angiography revealing hypofluorescence of these lesions in the early phase (b) with late phase staining of some of such lesions (c). After 6 months, the previously yellowish-white lesions regressed to faint chorioretinal lesions with hyperpigmentation of the affected areas in both eyes (d)

and amoxicillin or cefuroxime for adults, younger children, pregnant or breastfeeding women. A 14–21-day course of antibiotics is usually recommended, but some studies suggest that courses lasting 10–14 days are equally effective.[14] Patients with certain neurological or cardiac forms of illness may require intravenous treatment with drugs such as ceftriaxone or penicillin. Topical corticosteroids can be used for anterior segment inflammation. An antibiotic therapeutic trial can be used for posterior segment or neuro-ophthalmic disease.[15] Systemic corticosteroids without concomitant antibiotics should not be used in the treatment of ocular Lyme disease. If ocular Lyme disease is discovered and treated early, response to therapy is usually satisfactory.[15] Patients treated with appropriate antibiotics in the early stages usually recover rapidly and completely. Both our patients were reviewed at frequent intervals, keeping in mind the possibility of Lyme-like disease, which thankfully did not develop.

The rickettsial diseases that were believed to have disappeared from India are reemerging and their presence has recently been documented in at least 11 states in the country.[16] Many cases of rickettsial diseases go undiagnosed due to lack

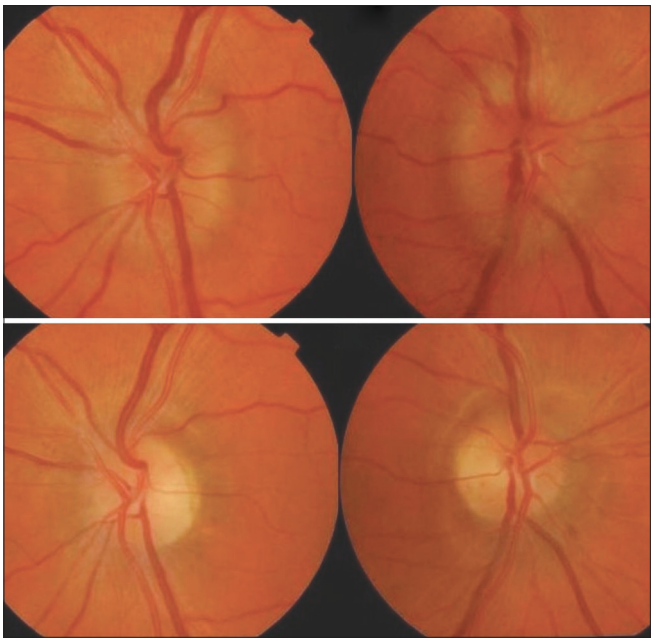

Figure 7: Optic disc appearance at presentation before treatment commenced and after treatment was completed, 3 months later

of diagnostic tools. Greater clinical awareness, a higher index of suspicion, and better use of available diagnostic tools would increase the frequency with which rickettsial diseases are diagnosed.[16] These are the only reports from ophthalmology where the ticks have been appraised in detail.

Conclusion

Early detection and treatment of tick-borne diseases is important to prevent multisystem complications that can develop any time later in life.

Acknowledgment

We thank:

- Dr. Keith Ryan of Plymouth, UK, for the help rendered in getting the electron microscopy images of the tick
- The editor and authors of Indian Journal of Dermatology, Venereology, and Leprology; Jairath V, Sehrawat M, Jindal N, Jain VK and Aggarwal *P* for for the image 5 from their article on Lyme disease in Haryana, India
- Katherine McVeigh and Georgios Vakros from the Department of Ophthalmology, Raigmore Hospital, Inverness, United Kingdom, for the image 7 from their article on papillitis as the sole presenting sign in Lyme's disease
- The editor and authors of Clinical Medical Reviews and Case Reports; Wang M, Khurana RN, Hopkins JJ and Rao NA for the image 6 on APMPPE from their article about Ocular Lyme Disease Simulating Acute Posterior Multifocal Placoid Pigment Epitheliopathy.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Daszak P, Cunningham AA, Hyatt AD. Anthropogenic environmental change and the emergence of infectious diseases in wildlife. Acta Trop 2001;78:103-16.
2. Gale A, Ringdhal E. Tick-borne diseases. Am Fam Physician 2001;64:461-7.
3. Vasudevan B, Chatterjee M. Lyme borreliosis and skin. Indian J Dermatol 2013;58:167-74.
4. Taylor LH, Latham SM, Woolhouse ME. Risk factors for human disease emergence. Philos Trans R Soc Lond B Biol Sci 2001;356:983-9.
5. Sanson T, Kulkarni R, Danzl D, Edlow JA, Hirshon JM, Talavera F. Tick-Borne Diseases. Available from: http://emedicine.medscape.com/article/786652-overview#showall. [Last accessed on 2014 Jan 01].
6. Parola P, Socolovschi C, Jeanjean L, Bitam I, Fournier PE, Sotto A, *et al.* Warmer weather linked to tick attack and emergence of severe rickettsioses. PLoS Negl Trop Dis 2008;2:e338.
7. Centers for Disease Control and Prevention, Division of Vector-Borne Diseases (DVBD). Tick Borne Diseases – A Reference Manual for Health Care Workers. USA: National Center for Emerging and Zoonotic Infectious Diseases (NCEZID); 2013. Available from: http://www.cdc.gov/lyme/removal/index.html. [Last accessed on 2014 Jan 01].
8. Boyé T. What kind of clinical, epidemiological, and biological data is essential for the diagnosis of Lyme borreliosis? Dermatological and ophthalmological courses of Lyme borreliosis. Méd Mal Infect 2007;37:S175-88.
9. Juckett G. Arthropod bites. Am Fam Physician 2013;88:841-7.
10. Mora P, Carta A. Ocular manifestations of Lyme borreliosis in Europe. Int J Med Sci 2009;6:124-5.
11. Wang M, Khurana RN, Hopkins JJ, Rao NA. Ocular Lyme disease simulating acute posterior multifocal placoid pigment epitheliopathy. Clin Med Rev Case Rep 2015;2:21.
12. Klaeger AJ, Herbort CP. Cotton wool spots as possible indicators of retinal vascular pathology in ocular Lyme borreliosis. Int Ophthalmol 2010;30:599-602.
13. McVeigh K, Vakros G. Case report: Papillitis as the sole ocular sign in Lyme disease. Clin Ophthalmol 2012;6:1093-7.
14. Wormser GP, Dattwyler RJ, Shapiro ED, Halperin JJ, Steere AC, Klempner MS, *et al*. The clinical assessment, treatment, and prevention of Lyme disease, human granulocytic anaplasmosis, and babesiosis: Clinical practice guidelines by the Infectious Diseases Society of America. Clin Infect Dis 2006;43:1089-134.
15. Zaidman GW. The ocular manifestations of Lyme disease. Int Ophthalmol Clin 1993;33:9-22.
16. Mahajan SK. Rickettsial diseases. J Assoc Physicians India 2012;60:37-44.