Title: Tired Lyme Eyes

This case focuses on a patient with a current diagnosis of Lyme disease and a symptomatic binocular vision. Emphasis is placed on identifying whether patient’s symptoms are related to the infection or non-strabismic binocular anomalies.

I. Case History

- Patient demographics: 14 year old Caucasian male
- Chief complaint: distance binocular diplopia, exacerbated at night and with fatigue. “words moving on the page” and losing his place while reading.
- Ocular, medical history
  - Lyme disease: diagnosed in 2012 via serological testing and patient symptoms
  - Co-Infection from *Babesia microti* and Candida albicans, diagnosed in 2012 via serological testing
- Medications

- Other salient information: Patient was admitted to hospital with a diagnosis of “relapsing fever” in 2010. At that time, the patient experienced a re-occurrence of relapsing fever and was later diagnosed with Lyme disease. No tick bite was identified on the initial presentation, but blood test revealed antibodies positive for *B. burgdorferi.*
  - Patient also experienced severe fatigue which disabled him to the point of being unable to get out of bed in the morning.

II. Pertinent findings

- Clinical:
  - Visual acuity, contrast sensitivity, color vision are within normal limits when measured with each eye separately, which suggests normal visual function and intact afferent pathway.
  - Pupils are equal, round, and reactive to light with negative relative afferent pupillary defect and variable. Normal visual fields were established by Goldmann visual fields, suggesting an intact afferent pathway
  - Ocular motility is neurologically intact. No extraocular muscle restrictions, ocular motor palsy and nystagmus is observed during careful evaluation.
- Convergence Insufficiency Symptoms Survey score is 30
- Patient has an ocular posture of basic exophore and sensory fusion is confirmed with Worth Light test at all distances. The subjective observation of blurry image for left eye is later revealed as significant accommodative anomalies.
- Near point of convergence is significantly reduced to 19 centimeters. With trial lenses, near point of convergence improves slightly with base in prism. This is an indication of convergence insufficiency. Subjectively, patient prefers base out prism for near.
- Vergences ranges at distance and near are within norms.
- Vergence facility is mildly reduced with difficulty with base in prism.
- Accommodative amplitude is reduced in each eye when measured separately.
- Accommodative facility is reduced monocularly as well as binocularly. During testing, subjectively patient reports a delay in ability to see clear with plus lenses.
- Patient’s accommodative-convergence/accommodation ratio is 2:1
- With trial lenses, patient appreciates +1.00 OU at near. Patient has an accommodative lag of +0.50D OD and +0.25D OS which is consistent with his finding of convergence insufficiency.
- Near point of convergence improves slightly with base in prism.
- Anterior segment health is unremarkable with intra-ocular pressures within norms for both eyes.
- Posterior segment examination is significant for a small retinal hemorrhage superior to the optic nerve head in the left eye.

### III. Differential diagnosis

- Primary/leading
  - Accommodative insufficiency
  - Accommodative infacility
  - Gross Convergence Insufficiency
  - Convergence spasm
  - Low AC:A ratio
- Others
  - Neurological manifestations of Lyme disease as a cause of convergence insufficiency, accommodative insufficiency, and accommodative infacility.
IV. Diagnosis and discussion

- Elaborate on the condition

  - Patient’s main symptoms are a result of his binocular system status. His distance and near viewing is affected by the interplay between his accommodation and convergence system. The definition of AC/A states that with every diopter of accommodative response a certain amount of accommodative convergence occurs. The decreased ability to accommodate and a low AC/A does not allow our patient to adequately stimulate his convergence system by the use of his accommodative system.

  - As demonstrated by the acceptance of plus lenses at near and preference of base out prism at near, patient’s accommodative system is weaker as compared to his convergence system and his convergence is attempting to drive his accommodation (CA/A).

  - It is suspected that prior to the exacerbation of patient’s symptoms associated with Lyme disease, patient was able to compensate for a weaker accommodative system by recruiting his vergence system in order to assist his accommodative system. Due to patient experiencing symptoms of severe fatigue caused by Lyme disease, patient is unable to recruit his vergence system and unable to sustain his accommodative system in order maintain clear, single binocular vision. With the prescription of plus lenses at hear, the goal is to aid his accommodation at near.

- Expound on unique features

  - Patient’s binocular vision difficulties are due to fatigue and a low AC/A rather than a result of neurological manifestations of Lyme disease.

  - Accommodation and convergence palsies are caused by neurological disorders that affect the supra-nuclear neurons. For a convergence palsy, ophthalmological examination of ocular motilities will reveal a gaze palsy that can be confirmed with forced duction testing. For an accommodation palsy, there will be absence of any accommodation, however pupils will respond to light as well as monocular and binocular near stimulation. This case illustrates the importance of more precisely differentiating between previous accommodative and vergence anomalies versus more recently acquired anomalies.

V. Treatment, management

- Treatment and response to treatment

  - Near single vision reading glasses with +0.75D ADD were prescribed for use with near work.
• Patient referred to retinal specialist for further evaluation of posterior segment findings of small retinal hemorrhage due to suspected association with Lyme disease and its co-infections.

• Bibliography, literature review encouraged


**VI. Conclusion**

- Clinical pearls

A diagnosis of Lyme disease can be elusive when certain diagnostic criteria are not met. It is the most common vector borne illness in the United States. In a report from 2012, the CDC stated that incidence of Lyme disease was reported in 41 states with 95% of reported cases concentrated in the northeast and upper Midwest. There have been
scattered cases identified all over the United States, including local areas of California and other west coast areas.

- The dissemination of *Borrelia sphiromote* is mainly hematogenously which results in the multisystem presentations of Lyme disease. Neuro-Lyme disease or Lyme Neuroboreliosis occurs when the systemic infection caused by the spirochete results in neurological involvement.

- It is important to be aware of the systemic manifestations at different stages of the disease in order to rule out findings as

- **Stage 1: Infection**
  - Dermatologic: Erythema migrans
  - Lymph: lymphadenopathy
  - Neurological: headache, stiff neck, nausea
  - Ophthalmologic: conjunctivitis, photophobia

- **Stage 2: dissemination**
  - Dermatologic: erythema chronicum migrans, lymphocytoma
  - Cardiologic: palpitations, arrhythmia, heart block, myocarditis
  - Rheumatologic: arthralgia
  - Neurologic: meningitis with papilledema, cranial neuritis, facial diplegia, painful radiculopathy, encephalitis
  - Ophthalmologic: Iridocyclus/uveitis, vitritis, pars planitis, choroiditis, panophthalmitis, macular edema, optic disc, edema, optic disc pallor, neuroretinitis, Anterior Ischemic Optic Neuropathy, Horner’s syndrome and Argyll Robertson-like pupils.

- **Stage 3: Late-immunological**
  - Dermatologic: achrodermatitis chronica atrophicans
  - Rheumatologic: arthralgia
  - Neurologic: fatigue, encephalomyelitis, demyelination (multiple sclerosis-like), anorexia nervosa, recurrent strokes, dementia
  - Ophthalmologic: stromal keratitis, episcleritis, orbital myositis, chronic intraocular inflammation