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Case Report

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Optic Neuropathy in Wernicke Encephalopathy

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Abstract

Wernicke Encephalopathy (WE) is an acute neurological condition caused by thiamine deficiency, with the classic clinical triad consisting of altered mental status, cerebellar ataxia, and ophthalmoplegia. Optic neuropathy in the setting of WE is rare but can range from mild retinal nerve fiber layer thickening to diffuse optic nerve head edema with peripapillary and retinal hemorrhages associated with loss of vision up to no light perception vision. We present a case of a 30-year male who presented with the classic signs and symptoms of Wernicke encephalopathy but with the rare clinical finding of optic nerve head edema. Our case presents this rare finding as well as discusses the clinical workup, imaging findings, treatment, and visual prognosis of optic neuropathy in Wernicke encephalopathy.

Keywords: Optic nerve head edema; Optic neuropathy; Thiamine deficiency; Wernicke encephalopathy

Introduction

The classic clinical trial of Wernicke encephalopathy consists of altered mental status, cerebellar ataxia, and ophthalmoplegia, however it is rare for all three to occur simultaneously [1]. Perhaps even more rare is the occurrence of optic nerve head edema which can range from mild retinal nerve fiber layer thickening to diffuse optic nerve head edema resulting in potentially severe vision loss [1-3]. Wernicke encephalopathy in the setting of thiamine deficiency is typically found in those with alcohol use disorder or those who have undergone gastric bypass surgery, but other unconventional factors can produce the same deficiency as demonstrated in our patient [4]. Radiographic imaging can be beneficial in elucidating insult to the thalamus and prompt treatment is associated with good prognosis. Visual prognosis with improvement or resolution in optic nerve head edema is also good if the entity is treated properly.

Although the ophthalmic presentation of ophthalmoplegia in Wernicke encephalopathy is well documented in the literature, we present a rare case of associated bilateral optic nerve head edema and vision loss stemming from an unconventional etiology.

Case Report

A 30-year-old right-handed security worker with a history of hypothyroidism and morbid obesity (Body Mass Index (BMI) of 42 kg/m^2) presented with vision loss and diplopia. He noticed blurry vision in both eyes a few hours apart that began 10 days prior to presentation. His eyes were starting to "cross inwards" 3 days prior to hospitalization. He reported difficulty with walking around the house which he attributed to poor vision. Roughly one month preceding these symptoms, he started experiencing persistent nausea and vomiting along with dysphagia. Barium swallow study was normal, but Esopha Gogastroduo Denoscopy (EGD) identified a stricture which was dilated, however his symptoms persisted. His wife added that he was only able to tolerate 4 ounces of mashed potatoes and small amounts of clear liquids per meals at most over this month span. His persistent Gastro Intestinal (GI) symptoms and associated dietary changes resulted in a relatively rapid 120-pound unintentional weight loss.

Upon arrival to the Emergency Department (ED) he was noted to have frank visual impairment and therefore ophthalmology was consulted. Vision was limited to light perception only bilaterally thus visual fields and color vision could therefore not be accurately evaluated. On motility testing, complete inability to abduct was present bilaterally with both duction and versions testing, as well as esotropia. On dilated funduscopic examination, the optic nerve heads were found to have small cup-to-disc ratios, Frisen grade 2 swelling, and diffuse peripapillary retinal hemorrhages bilaterally.

While in the ED he had a witnessed seizure described as a one-minute episode of generalized tonicity followed by clonic convulsive activity with loss of consciousness and urinary incontinence. This resolved spontaneously without treatment, and neurology was then consulted. On neurological examination he was lethargic and difficult to keep aroused, and he was disoriented to place. His pupils were equal and reactive without relative afferent pupillary defect. He had bilateral abducens palsy, otherwise cranial nerves were intact. There was no noticeable salivary pooling or hyper-nasal speech. Limb strength was 5/5 throughout, reflexes were 2+ and symmetric throughout. He exhibited mild truncal ataxia while sitting, but limb coordination appeared normal other than for limitations due to poor vision. Sensation to all modalities was intact in upper and lower extremities, trunk, and face. Gait assessment was limited as he endorsed feeling very uncomfortable due to the visual impairment. He exhibited wide based stance and staggered gait with two steps. The patient appeared to have cerebellar ataxia with an ataxic gait on exam, however this was somewhat confounded by his initial degree of visual impairment.

He exhibited several neurologic and ophthalmologic signs including ophthalmoplegia, optic nerve head swelling and peripapillary hemorrhages, visual acuity impairment, seizure, and mild truncal ataxia. His symptoms were proceeded by prolonged dysphagia and weight loss. Initially there was consideration for a neuromuscular junction disorder given ophthalmoparesis along with bulbar symptoms (dysphagia), however, this would clearly not explain the fundoscopic findings. Another consideration was Cerebral Venous Thrombosis (CVT), or any acute etiology of increased Intracranial Pressure (ICP), which could explain his bilateral abducens palsy, optic nerve head swelling, as well as his seizure. Demyelinating processes were also initially considered including neuromyelitis optica based on the apparent bilateral optic neuritis along with the one-month history of nausea and vomiting which would be typical for presentation of area postrema syndrome. Though less likely, multiple compressive or infiltrative lesions could contribute to the appearance of the optic nerves and visual deficiencies and depending on location may also explain the seizure. Hereditary optic neuropathy should also be considered in a young patient with sub-acute vision loss and optic nerve pathology, however, he did not endorse any family history of known optic neuropathy. There was no personal history of radiation exposure/treatment (ruling out radiation optic neuropathy), but he did report keeping cats as pets so neuroretinitis secondary to Bartonella Hensle was on the differential. Finally, nutritional optic neuropathy was considered given the history of persistent nausea, vomiting, and dysphagia with rapid 120-pound weight loss, especially given bilateral simultaneous ocular findings. Nutritional deficiencies could also explain his ataxia and abducens palsies which are part of the typical triad of Wernicke Encephalopathy (WE). Please see (Table 1, 2) for differential diagnoses for binocular diplopia and optic neuropathy, respectively. Interestingly, the patient was not actually cachectic but rather was obese, and was a non-alcoholic with no dietary restriction of thiamine prior to the GI symptom onset one month prior.

Localization	**Differential Diagnosis**			
Ocular Muscles	Thyroid-associated ophthalmopathy	Congenital myopathies	Muscular dystrophy	Compression- intra-orbital mass, hemorrhage, trauma
Neuromuscular Junction	Myasthenia gravis	Botulism		
Cranial Nerves (III, IV, VI)	Microvascular ischemia- diabetic neuropathy	Compression- aneurysm, orbital mass, hemorrhage, herniation, cavernous sinus thrombosis, trauma	Autoimmune disorders- AIDP variants (Miller-Fisher syndrome)	Thiamine deficiency
Brainstem	Ischemic/hemorrhagic stroke	Autoimmune disorders- multiple sclerosis, neurosarcoidosis, Neuromyelitis optica	Compression- herniation, tumor, hemorrhage	

Table 1: Localization and Differential Diagnosis for Binocular Diplopia.

Entity:	Example:	Entity:	Example:
Optic Neuritis	Demyelinating disease such as multiple sclerosis	**Radiation exposure**	Radiation therapy for intracranial lesions
Papilledema	Elevated intracranial pressure from hydrocephalus or cavernous sinus thrombosis	**Toxic**	Methanol, ethanol
Trauma	Direct or indirect traumatic optic neuropathy	**Idiopathic**	Trauma during nerve sheath fenestration or pituitary adenoma resection
Infiltrative	Lymphoma or leukemia	**Neoplasm**	Optic nerve glioma, sphenoid wing meningioma
Compression	Tumor mass effect	**Glaucoma**	Open or closed angle glaucoma
Hereditary	Leber hereditary optic neuropathy, autosomal dominant optic neuropathy	**Infectious**	Bartonella henslea, tuberculosis

Table 2: Differential Diagnosis for Optic Neuropathy.

Laboratory evaluation including comprehensive metabolic panel revealed mild elevation in total bilirubin at 3.3mg/dL (normal 0.2-1.2) as well as AST and ALT at 43[IU]/L and 102[IU]/L (normal 0-40 and 0-68 respectively), and sodium of 132meq/L. Thyroid Stimulating Hormone (TSH) was elevated at 6.18[IU]/L (normal 0.36-3.74) and T4 was within normal range. Thiamine was 63 nmol/L (normal 70-180). Magnesium was normal at 2.3mg/dL. NMO-Aquaporin-4 receptor antibody, angiotensin converting enzyme, and Quintana IgG/IgM were negative. Lumbar puncture revealed an opening pressure of 15 cm H2O and Cerebrospinal Fluid (CSF) testing showed 1 WBC, protein 47.8, and glucose 52. Additional CSF infectious studies were normal/negative. Electroencephalogram (EEG) revealed a normal awake, drowsy, and sleep study.

Computed Tomography (CT) of the head was normal. Magnetic Resonance Venography (MRV) was done to rule out CVT and showed no obstruction or occlusion within intracranial venous system. However, Magnetic Resonance Imaging (MRI) of brain and orbits with and without contrast revealed increased T2 Fluid-Attenuate Inversion Recovery (FLAIR) signal and increased signal on Diffuse Weighted Imaging (DWI) sequences without reduced Apparent Diffusion Coefficient (ADC) signal in the bilateral dorsomedial thalami as well as minimally increased T2 FLAIR signal in the periaqueductal gray matter (Figure 1).

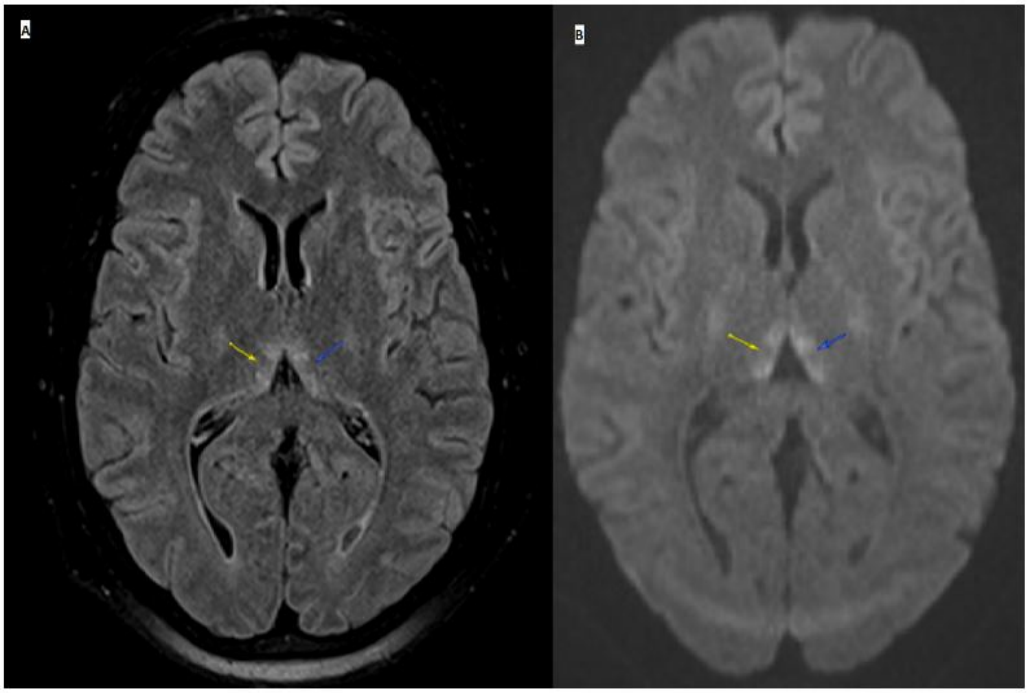

Figure 1: MRI of orbits with and without contrast showing increased T2 fluid-attenuate inversion recovery (FLAIR) signal (A) and increased signal on diffuse weighted imaging (DWI) sequences (B) without reduced apparent diffusion coefficient (ADC) signal (not shown) in the bilateral dorsomedial thalami as well as minimally increased T2 FLAIR signal in the periaqueductal gray matter (not shown).

Given the thiamine deficiency, MRI findings, and clinical picture, this was most consistent with WE.

He was given thiamine 500mg intravenous (IV) three times daily for three days followed by 500mg IV daily for 2 days. Within 48 hours he had marked improvement in his visual impairment and near complete resolution of his abducens palsy. He was discharged with 100mg oral thiamine daily. He had follow-up in our neurology and neuro-ophthalmology clinic within one month and had complete resolution of ataxia. His vision had improved to his baseline of 20/20 with myopic correction and intact color vision in both eyes. A small angle esotropia was still evident with subsequent diplopia, but this was markedly improved from presentation and only mildly symptomatic. Version testing revealed cardinal gazes with no obvious abducens deficits. Examination of the fundus revealed resolution of the optic nerve head edema and resolving peripapillary hemorrhages. Normal thickness of the optic nerve retinal nerve fiber layer in both eyes was confirmed on optical coherence tomography. The mild esotropia with diplopia was managed with a small prism diopter trial of Fresnel lenses.

His ataxic gait improved dramatically after correcting his thiamine deficiency. EMG/NCS were considered but ultimately not performed due to rapid correction of ataxia and no sensory deficits elicited on neurological examination.

In regards to the patient's dysphagia, no structural cause of dysphagia was found during hospitalization. The patient's dysphagia did not improve after correction of thiamine deficiency. He was evaluated by speech therapy and passed a modified barium swallow study and was cleared for normal diet during hospitalization. The patient was evaluated by the gastroenterology service and underwent a second EGD during his hospitalization which showed the same dilated stricture previously seen. He continued to complain of dysphagia for months following his discharge. The etiology remains unclear and could potentially have been functional.

Discussion

Wernicke encephalopathy is an acute neurological condition caused by thiamine deficiency, with the classic clinical triad consisting of altered mental status, cerebellar ataxia, and ophthalmoplegia. However, all three together occur in less than one-third of affected patients [1]. Optic neuropathy in the setting of WE is rare but can range from mild retinal nerve fiber layer thickening to diffuse optic nerve head edema with peripapillary and retinal hemorrhages associated with loss of vision up to no light perception vision [2]. Additionally, ophthalmoplegia (most commonly abducens nerve palsy) can lead to binocular diplopia. The manifestations of optic nerve edema, vision loss, and ophthalmoplegia are typically reversible and respond well to treatment if administered early. Epileptic seizures may be related to cortical lesions and abnormal metabolism due to thiamine deficiency as reported by Shang et al in a literature review but are rare in non-alcoholic WE [3].

Thiamine deficiency leading to WE is seen most commonly in those with an alcohol use disorder or in those who have undergone gastric by-pass surgery [4]. However, other scenarios that result in prolonged dietary deficiency such as hyperemesis gravidarum or anorexia nervosa, GI illness or chronic dysphagia, malignancies, or liver disease can also contribute to thiamine deficiency. Thiamine availability depends on intake, usage, and storage and is found in meat such as pork, as well as in yeast, whole grains, and legumes. Since the 1930s, flour has been enriched with thiamine in the United States. However, Western diets typically consist of oils, fats, and refined sugars which are all deplete of thiamine, therefore overall thiamine stores in our population in the U.S. tend to be low. Thiamine requirement also increases as total caloric intake and carbohydrate intake each increase [5].Given that our American diet is mostly composed of oils, fats, and refined sugars, and is often high in calories and carbohydrates, we may have a relative predisposition to thiamine deficiency. This concept has been further supported in a study published in 2005 by a group of bariatric surgeons revealing that 47 out of 303 obese patients were thiamine deficient preoperatively [6]. Even in patients with adequate thiamine stores, deficiency has been shown to occur within 2-3 weeks after cessation of oral intake.

For radiographic confirmation brain MRI is more sensitive than CT in the evaluation of changes attributed to WE. Typical MRI findings include FLAIR and T2 hyperintensity of the bilateral medial thalami, periaqueductal gray, mammillary bodies, inferior colliculi, and pontine tegmentum [1]. Since the sensitivity of head CT and brain MRI in diagnosing WE is only approximately 10% and 50%, respectively, negative, or atypical neuroimaging findings should not exclude the diagnosis of WE [1].

Currently there is no gold standard for dosage of thiamine or route of administration. Initial treatment with oral supplementation has not been shown to be beneficial in patients with WE. Most sources recommend up to 500 mg three times a day for two consecutive days followed by 250 mg IV or IM once daily for five days, with additional treatment being based on the clinical response [7]. Hypomagnesemia has been found to be deficient in some alcoholic patients and has been detected in cases refractory to treatment with thiamine alone [8]. So, in cases of WE, patients should also be tested and treated for hypomagnesemia as this is an important transporter and co-factor for thiamine utilization. Some have recommended empiric treatment with a combination of thiamine, magnesium, and folic acid [9].

Although rare, optic neuropathy including optic nerve head edema leading to vision loss can be discovered in patients with Wernicke encephalopathy. The differential diagnosis for optic neuropathy is broad but physicians should consider Wernicke encephalopathy in the correct clinical setting as this can give the ophthalmologist and thus the patient insight on the visual prognosis with prompt treatment.

References

1. GianPietro S, Serra A (2007) Wernicke's encephalopathy: new clinical settings and recent advances in diagnosis and management. The Lancet Neurology 6: 442-455.
2. Cogan DG, Victor M (1954) Ocular signs of wernicke's disease. AMA Arch Ophthalmol 51: 204-211.
3. Shang W, Chen X, Li X, et al. (2017) Epileptic seizures in nonalcoholic Wernicke's encephalopathy: a case report and literature review. Metabolic Brain Disease 32: 2085-2093.
4. Kulkarni, Sonalee, et al. (2005) "You are what you eat." Survey of ophthalmology 50: 389-393.
5. Sean GM, Lam BL (2014) Visual loss and optic nerve head swelling in thiamine deficiency without prolonged dietary deficiency 22: 1021-4.
6. Lester C, Kaidar-Person O, Rosenthal R, et al. (2005) Preoperative thiamine deficiency in obese population undergoing laparoscopic bariatric surgery. Surgery for Obesity and Related Diseases 1: 518-522.
7. Cook CC, Hallwood PM, Thomson AD (1998) B Vitamin deficiency and neuropsychiatric syndromes in alcohol misuse. Alcohol Alcohol 33: 317-36.
8. Allan TD, Cook CCH, Touquet R, et al. (2002) The Royal College of Physicians report on alcohol: guidelines for managing Wernicke's encephalopathy in the accident and emergency department. Alcohol and Alcoholism 37: 513-521.
9. Alexander FH, David AA, Aaron CM (2016) Unpeeling the Evidence for the Banana Bag: Evidence-Based Recommendations for the Management of Alcohol-Associated Vitamin and Electrolyte Deficiencies in the ICU. Crit Care Med 44:1545-1552.