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AFTERIMAGES

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Combined Optic Neuropathy and Myelopathy Secondary to Copper Deficiency

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Abstract. We report two patients, both with a history of gastric surgery, who presented with progressive optic neuropathy and myelopathy. The patients' symptoms were initially attributed to vitamin B12 deficiency and/or neuromyelitis optica; however, after the neurologic deficits continued to progress with the use of conventional treatments, further evaluation was initiated, and a severe copper deficiency was revealed. Copper deficiency is a rare cause of progressive optic neuropathy and myelopathy and should be considered in the differential diagnosis. It is crucial to elicit a history of gastric surgery or other risk factors for hypocupremia in those patients undergoing an evaluation for subacute or chronically progressive optic neuropathy or myelopathy. (**Surv Ophthalmol 55**:386–392, 2010.

Key words. copper deficiency • gastric bypass • myelopathy • optic neuropathy • vitamin B12 deficiency

As obesity in the United States has reached pandemic proportions, the number of gastric surgeries, particularly bariatric gastric bypass surgery, has rapidly increased.[2] With this increase, newly characterized complications related to vitamin and mineral deficiencies have become apparent. Previously described neurologic complications from vitamin or mineral deficiencies after gastric surgery have included encephalopathy, optic neuropathy, myelopathy, polyneuropathy, and myopathy.[2] We recently evaluated two patients with a remote history of gastric surgery who presented with subacute progressive optic neuropathy combined with posterior spinal cord myelopathy, manifesting as lower extremity weakness, spasticity, and ataxia. The neurologic manifestations in these cases were initially attributed to neuromyelitis optica and/or vitamin B12 deficiency. Eventually, severe copper deficiency, a rare, but well characterized, cause of optic neuropathy and postero-lateral myelopathy, was discovered. We detail the two case presentations, the pitfalls encountered in uncovering the diagnosis, and a discussion of copper deficiency myelo-optico-neuropathy.

Case Reports

CASE 1

A 66-year-old woman with a history of a partial gastrectomy for the treatment of gastric ulcers

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7 years prior to presentation, hypertension, and iron-deficiency anemia presented with a 2-year history of gradual vision loss, progressive loss of distal lower extremity sensation, and ataxia. Her medications included Advair, Norvasc, Lasix, hydralazine, isosorbide, potassium, lisinopril, metoprolol, Fosamax, and Lunesta. There was no family history of ophthalmologic or neurologic disease. Her referring physician had initiated a laboratory work-up (including HIV, Lyme, ACE, RPR, ANCA, and lumbar puncture) that revealed only a low vitamin B12; therefore, the diagnosis of subacute combined degeneration secondary to B12 deficiency (presumably due to her remote history of partial gastrectomy) was proposed. Treatment with vitamin B12 was initiated. After her B12 levels normalized, however, the patient continued to note progressive worsening of her vision, and her ataxia and weakness increased to the level that she became wheelchair-dependent. Magnetic resonance imaging (MRI) of the brain did not reveal any abnormalities.

Upon presentation to us, the patient's predominant visual complaint was diminished peripheral vision. She also noted a gradual worsening of her color vision. Ophthalmologic examination revealed a visual acuity of 20/40 bilaterally. Her color vision was severely reduced, and fundus examination revealed optic atrophy bilaterally. Her automated visual fields showed progressive constriction over a 1-year period while undergoing treatment with vitamin B12 (Fig. 1). Optical coherence tomography (OCT) revealed a mean retinal nerve fiber layer thickness of 81 μm and 85 μm in her right and left eyes, respectively, compared to 100 μm and 119 μm on an OCT performed 2 years previously. An electroretinogram (ERG) revealed normal scotopic and photopic responses. Additionally, her strength was decreased in the lower extremities, and to a lesser extent in the upper extremities. Vibratory sense and touch were decreased to the hips and to the elbows bilaterally. She demonstrated limb dysmetria, and she was only able to take a few steps with a walker. Her reflexes were pathologically brisk, with the exception of the ankle reflexes, which were absent. Both plantar responses were extensor. Given the progression of her symptoms after normalization of her B12 levels, further laboratory evaluation was undertaken. The copper level was found to be very low (22 μg/dL, normal=70–155 μg/dL). Her vitamin A and B12 levels were within normal limits. Oral copper supplementation was initiated, but her copper levels failed to increase. A gastrointestinal evaluation revealed small bowel bacterial overgrowth, and the patient required intravenous copper to maintain her copper level at a low-normal state. There has been no subjective improvement in her ophthalmologic or neurologic complaints, but also been no further deterioration.

CASE 2

A 42-year-old woman with a history of osteoporosis, fibromyalgia, and iron deficiency anemia presented with a 1-year history of gradual vision loss, ataxia, and bilateral lower extremity weakness and numbness. She had a remote (>20 years) history of gastric bypass surgery and of a surgically drained brain abscess. Her visual complaints included diminished peripheral vision, poor color vision, and difficulty resolving distant objects. She had also recently noted urinary incontinence and difficulty with ambulation, such that she required a walker or a wheelchair at all times. Her medications included Keppra, Reglan, Benadryl, Cymbalta, Abilify, Klonopin, Detrol LA, Synthroid, Adderal, and Lyrica. There was no family history of any ophthalmologic or neurologic diseases. Her neurologic examination revealed moderate lower extremity weakness. There was decreased sensation to light touch, proprioception, and vibration in the lower extremities and in the distal hands. There was hyperreflexia throughout, and both plantar responses were extensor. Ophthalmic examination revealed a best corrected visual acuity of 20/40 OU. Her visual fields were constricted to approximately 15° at 1 m on a tangent screen and expanded appropriately at increasing testing distance. Color vision was decreased bilaterally. Ophthalmoscopy revealed bilateral optic atrophy, especially temporally. Automated visual field testing was unreliable, and her OCT revealed retinal nerve fiber layer thinning bilaterally (Fig. 2). She was admitted to the hospital and underwent an extensive work-up including lab work, lumbar puncture, MRI of the brain and spinal cord, and a chest CT. Neuroimaging revealed T2 high-signal abnormality in the cervical and thoracic spinal cord, thought to be consistent with demyelination (Fig. 3). The cervical cord lesion spanned C2–C5/6 and predominately affected the posterior spinal cord. There were no similar lesions in the brain, and there were no signal abnormalities in the optic nerves. Laboratory evaluation revealed a normal vitamin B12, homocysteine, methylmalonic acid, HIV, Lyme, ACE, RPR, ANCA, and a normal CSF profile, with an absence of oligoclonal bands. A visual evoked potential revealed slowed conduction velocities bilaterally.

Given the patient's presentation with long spinal cord lesions consistent with demyelination, evidence of optic nerve involvement, and lack of brain lesions, a presumptive diagnosis of neuromyelitis optica (NMO) was made, although the NMO antibody test (Mayo Clinic, Rochester, MN)