Resolution of Hypothyroidism After Correction of Somatovisceral Reflex Dysfunction by Refusion of the Cervical Spine

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Psychosis is a rare initial presentation of new-onset hypothyroidism. The author describes the case of a 29-year-old woman who presented with psychosis caused by hypothyroidism, or *myxedema madness*. Although the patient's psychosis resolved after standard monotherapy using levothyroxine sodium, her hypothyroidism persisted. Imaging of the patient's cervical spine showed that previous C5-C6 and C6-C7 fusions had failed. The failed fusions were corrected, and the patient's hypothyroidism resolved, suggesting that the somatovisceral reflex was the cause of the patient's hypothyroidism. Although somatovisceral reflex dysfunctions are rare, physicians should consider them as potential underlying causes of their patients' presenting medical conditions.

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Hypothyroidism has several etiologic processes, but it is typically a result of insufficient production of thyroid hormones or insufficient action of thyroid hormones at the target organ receptor sites. Whereas primary hypothyroidism is caused by a thyroid disorder, secondary or central hypothyroidism is caused by hypothalamic or pituitary disorders.[1,2] Symptoms of hypothyroidism include fatigue, depression, weight gain, cold intolerance, dry skin and hair, constipation, excessive sleepiness, decreased concentration, and vague aches and pains. These symptoms are not in and of themselves pathognomonic of hypothyroidism; blood tests to detect changes in thyrotropin levels (increases in the case of primary hypothyroidism; decreases in the case of secondary or central hypothyroidism), as well as alterations in concentrations of the thyroid hormones triiodothyronine (T3) and thyroxine (T4), are necessary to confirm the diagnosis.[1,2]

The prevalence of overt clinical hypothyroidism is approximately 3 per 1000 people, whereas the prevalence of subclinical or mild hypothyroidism is approximately 46 per 1000 people.[3] The standard of care for these patients is monotherapy using levothyroxine sodium.[1,2]

In the present case, a patient presented with psychosis, which was discovered to be a result of new-onset hypothyroidism. Although standard therapy with levothyroxine sodium resolved the patient's psychosis, the patient's hypothyroidism persisted because of a rare somatovisceral reflex dysfunction. Refusion of the cervical spine corrected the patient's somatovisceral reflex dysfunction and resulted in resolution of the patient's hypothyroidism.

Report of Case

A 29-year-old woman who had been under the care of an osteopathic physician (M.R.B.) for 16 months was brought to the emergency department (ED) by her husband and mother after a suicidal ideation. The patient was immediately admitted to the psychiatric unit. The patient had a 3-year history of chronic pain secondary to left upper extremity reflex sympathetic dystrophy syndrome. Her medications included morphine sulfate (240 mg continuous release twice per day), which was supplemented by oxycodone (60 mg every 4-6 hours as needed for breakthrough pain), and duloxetine (60 mg daily for depression). The ED visit was triggered by a verbal argument between the patient and her mother, which led to the patient stating that she did not wish to continue to "live like this" and gesturing that she was ingesting what appeared to be a "handful" of her prescription pain medications. The patient had no previous medical or family history of psychiatric disorders.

The patient's pain symptoms began 3 years earlier after a waterskiing accident. The patient's surgical history was notable for anterior cervical spine fusions of the C4-C5 and C6-C7 vertebrae 3 years before presentation and of the C5-C6 vertebrae 18 months before presentation. These procedures were performed in an attempt to correct the patient's reflex sympathetic dystrophy syndrome and to alleviate the patient's pain. A magnetic resonance image and a plain radiograph of the patient's cervical spine showed that the C5-C6 and C6-C7 fusions had failed. Attempts to locate a spine and back orthopedic surgeon or a neurosurgeon to perform refusion surgery were unsuccessful. Nine months before admission to the ED, the patient was sent for placement of a neural stimulator to control her pain; the neural stimulator decreased the patient's pain for approximately 6 weeks, at which point the patient's pain began to increase. After conservative nonsteroidal anti-inflammatory drug pain control regimens failed, the patient was prescribed opioid pain medications to alleviate her pain symptoms. Six months before admission to the ED, the patient's pain was being controlled with the morphine sulfate, supplemental oxycodone, and duloxetine regimen described previously. Duloxetine was chosen because of its efficacy in managing both depression and the comorbid musculoskeletal components of depression.

Narcotic psychosis was initially diagnosed because of the patient's recent opioid use; however, findings of a toxicology screening revealed that the blood levels of the pain medications were in accordance with the patient's prescriptions, indicating that she had not ingested any additional medications. The blood tests also revealed a thyrotropin level of 20.770 uIU/mL (reference range, 0.450-4.500 uIU/mL). The patient had no previous medical or family history of thyroid or other endocrine disorders. The patient's hypothyroidism had resulted in psychosis, or *myxedema madness*. The patient received levothyroxine sodium (50 µg daily) and was referred to an endocrinologist for definitive workup of her new-onset hypothyroidism. The patient's psychosis symptoms abated, and the patient was discharged to home 3 days after she was admitted to the psychiatric unit. Approximately 1 week after the patient's discharge, the endocrinologist increased the patient's thyroid regimen to levothyroxine sodium 75 µg daily.

Seven months later, a spine orthopedic surgeon and a neurosurgeon were found, and they performed cervical spine refusions of the C5-C7 vertebrae using both anterior and posterior techniques. Within 8 weeks of the refusions, the patient stopped using all of her pain medication. Blood tests confirmed the lack of pain medication use and also showed that the patient's thyrotropin level had decreased to 1.160 uIU/mL (within reference range). During the 8 weeks after the procedures, the patient was weaned off duloxetine hydrochloride. At a follow-up appointment 12 weeks after the procedures, the patient was asked if she needed her levothyroxine sodium prescription refilled. The patient

stated that she had stopped taking levothyroxine sodium when she had finished her previous prescription 8 weeks earlier. Another blood test confirmed the thyrotropin level was stable at 1.140 uIU/mL.

Two years after the refusions, the patient remained free from needing opioid pain medications or requiring thyroid treatment.

Discussion

Heinrich and Grahm[4] stated that myxedema madness can be the presenting symptom of underlying hypothyroidism in approximately 15% of cases. Because myxedema is rare, however, it is often overlooked as the cause of psychosis.[5,6] As seen in our case and in previously reported cases,[7] hypothyroid-related psychosis typically resolves after the administration of levothyroxine sodium, the standard therapy for new-onset hypothyroidism.

In the present case, the patient's hypothyroidism was believed to be caused by a rare somatovisceral reflex dysfunction. Such dysfunctions of the thyroid have been described in the osteopathic literature for over a century. In the early 1900s, Burns[8] observed a relationship between somatic dysfunction of C4 through C7 and the thyroid in animal studies. During the next few decades, Webster[9(pp102-104,136-142)] and Unverferth[10] described the thyroid as a "somatovisceral responder" and as a viscerosomatic source of somatic dysfunctions. In the 1980s, Camilleri and colleagues[11] demonstrated gastric effects of somatovisceral reflexes in humans, and in the 1990s, Sato[12] demonstrated the existence of somatovisceral reflexes in experimental animals. Around the same time as Sato's work, Chang and colleagues[13] reported a small study demonstrating the existence of a somatovisceral pathway for the esophagus in humans. In the first edition of *Foundations for Osteopathic Medicine*,[14] Willard and colleagues described a feed-forward loop, or the process by which pathologic processes of the thyroid worsen somatic dysfunction and, in turn, somatic dysfunction worsens thyroid function.

Sympathetic innervation of the thyroid comes from the sympathetic fibers at spinal levels T1 through T4, which innervate both the blood vessels that supply the thyroid and the cells of the thyroid that produce its secretions.[15(pp4-6,187,192),16(pp491,493)] The superior, middle, and inferior cervical paraspinal ganglia are found in the fascia of the cervical spine at spinal levels C2, C6, and C7, respectively.[16(p491)] The fascia surrounding the thyroid cartilage and thyroid gland is continuous, extending from the occiput into the thorax.[17] Sympathetic innervation is believed to be associated with altering secretions of the thyroid.[15(pp4,187)] Parasympathetic innervation of the thyroid comes from the superior and inferior laryngeal nerves and a branch from the main vagus nerve.[15(pp5-6,192),16(pp491,493)] Despite some transient effects that have been demonstrated by sectioning parasympathetic innervation of the thyroid in rats,[18] the influence of parasympathetic innervation on the thyroid remains unknown.[15(p187)] It can be discerned that the neurologic and anatomic features of the cervical region influence thyroid function and that somatovisceral reflex dysfunction can result in hypothyroidism.

The most common sites of somatic dysfunction associated with thyroid problems include the upper cervical spine (C1-C2), the cervicothoracic junction (C7-T1), and the upper thoracic spine (T1-T4).[19] Resolution of the present patient's hypothyroidism occurred after surgical refusion of the patient's cervical spine at the C5-C7 vertebrae. For many cases of somatic dysfunctions related to thyroid viscerosomatic dysfunctions, however, osteopathic manipulative treatment of C4 through C6 is indicated.[19(p317)]

Conclusion

Psychosis is a rare initial presentation of new-onset hypothyroidism. In the present case, the patient's hypothyroidism resolved after the cervical spine was corrected, suggesting somatovisceral reflex dysfunction. Although somatovisceral reflex dysfunctions are rare, physicians

should consider them as potential underlying causes for their patients' presenting medical conditions.

References

1. Almandoz JP, Gharib H. Hypothyroidism: etiology, diagnosis, and management [published online February 14, 2012]. *Med Clin North Am*. 2012;96(2):203-221. doi:10.1016/j.mcna.2012.01.005.
2. Khandelwal D, Tandon N. Overt and subclinical hypothyroidism: who to treat and how. *Drugs*. 2012;72(1):17-33. doi:10.2165/11598070-000000000-00000.
3. Hollowell JG, Staehling NW, Flanders WD, et al. Serum TSH, T(4), and thyroid anibodies in the United States population (1988 to 1994): National Health and Nutrition Examination Survey (NHANES III). *J Clin Endocrinol Metab*. 2002;87(2):489-499.
4. Heinrich TW, Grahm G. Hypothyroidism presenting as psychosis: myxedema madness revisited. *Prim Care Companion J Clin Psychiatry*. 2003;5(6):260-266.
5. Arguello V, Hasan F, Yasmeen T. Myxedema madness: a case of misdiagnosed psychosis [abstract]. *Endocr Rev*. 2012;33(3):421.
6. Cook DM, Boyle PJ. Rapid reversal of myxedema madness with triiodothyronine [letter]. *Ann Intern Med*. 1986;104(6):893-894.
7. Shaw E, Halper J, Yi PE, Asch S. Diagnosis of 'myxedema madness' [letter]. *Am J Psychiatry*. 1985;142(5):655.
8. Burns L. Viscero-somatic and somato-visceral spinal reflexes. *J Am Osteopath Assoc*. 1907;7(2):51-60.
9. Webster GW. *Concerning Osteopathy*. Rev ed. Norwood, MA: Plimpton; 1917.
10. Unverferth EC. Goiter: a case report. In: *Applied Academy of Osteopathy 1940 Yearbook*. Indianapolis, IN: American Academy of Osteopathy; 1940:102-108.
11. Camilleri M, Malagelada JR, Kao PC, Zinsmeister AR. Effect of somatovisceral reflexes and selective dermatomal stimulation on postcibal antral pressure activity. *Am J Physiol*. 1984;247(6 pt 1):G703-G708.
12. Sato A. Somatovisceral reflexes. *J Manipulative Physiol Ther*. 1995;18(9):597-602.
13. Chang FY, Chey WY, Ouyang A. Effect of transcutaneous nerve stimulation on esophageal function in normal subjects—evidence for a somatovisceral reflex. *Am J Chin Med*. 1996;24(2):185-192.
14. Willard FH, Mokler DJ, Morgane PJ. Neuroendocrine-immune system and homeostasis. In: Ward RC, executive ed. *Foundations for Osteopathic Medicine*. Philadelphia, PA: Lippincott Williams & Wilkins; 1997:126-131.
15. Kuchera M, Kuchera W. *Osteopathic Considerations in Systemic Dysfunction*. Rev 2nd ed. Columbus, OH: Greyden Press; 1994.
16. Heinking KP, Kappler RE, Ramey KA. Head and occipital region. In: Chila AG, executive ed. *Foundations of Osteopathic Medicine*. 3rd ed. Baltimore, MD: Lippincott Williams & Wilkins; 2011.
17. Willard FH, Fossum C, Standley PR. The fascial system of the body. In: Chila AG, executive ed. *Foundations of Osteopathic Medicine*. 3rd ed. Baltimore, MD: Lippincott Williams & Wilkins; 2011:79.
18. Romeo HE, Diaz MC, Ceppi J, Zaninovich AA, Cardinalli DP. Effect of inferior laryngeal nerve section on thyroid function in rats. *Endocrinology*. 1988;122(6):2527-2532.
19. Jorgensen DJ. The Patient with Thyroid Disease. In: Nelson KE, Glonek T, eds. *Somatic Dysfunction in Osteopathic Family Medicine*. Philadelphia, PA: Lippincott Williams & Wilkins; 2007:304-323.