

Pituitary Perplexity

by

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John O'Malley is a 30-year-old non-verbal man with autism who attends a day program where he enjoys community activities and volunteer work. Several years ago, John developed severe maladaptive behaviors that were uncharacteristic of him. He was extremely anxious and developed aggressive behaviors. At that time, John's primary care physician ordered several blood tests to determine what might be bothering him. The doctor explained to John's parents that thyroid function tests are sometimes used to diagnose a thyroid condition when individuals develop behavioral issues. Since John's mother had been diagnosed with hypothyroidism, it was logical to order thyroid tests as this condition can run in families. John's thyroid stimulating hormone (TSH) was low, and his T4 level was in the normal range, albeit very low end of the normal range. Since John could not report symptoms and was clearly distraught, his doctor decided to measure the other hormones that are released from the anterior pituitary gland and a cortisol level (Table 1). The blood tests revealed follicle stimulating hormone (FSH), luteinizing hormone (LH), and growth hormone (GH) were all low as was his cortisol level. John's primary care physician was concerned about a possible brain abnormality and referred him to an endocrinologist.

Table 1. Initial test results for John's hormone levels. (Note: blood was drawn at 9 AM.)

	TSH	T4	T3 Free	LH	FSH	PRL	GH	Cortisol
Normal Range	0.40–4.50 mIU/mL	0.8–1.8 ng/dL	80–200 ng/dL	1.5–9.3 mIU/mL	1.6–8 mIU/mL	2.0–1.8 ng/mL	0.4–10 ng/mL	4–22 mcg/dL
John's Results	0.3 mIU/mL	0.8 ng/dL	99 ng/dL	0.9 mIU/mL	1.4 mIU/mL	1.0 ng/mL	0.3 ng/mL	3.8 mcg/dL

The endocrinologist ordered an MRI of his brain, and the results were normal. The endocrinologist thought that the hormonal decrease from the anterior pituitary gland might be due to stress. Several changes were made to John's day program to alleviate stress and one of his medications was reduced by his psychiatrist after this doctor viewed a video of John's agitated state. Within two months John's pituitary hormones normalized as one of his psychiatric medications was considerably reduced and he no longer needed to see the endocrinologist.

Four years later John's caregivers noted that John was having difficulty sleeping and that several times a night he would wake up and pace in the hallway. He was overheated despite having air conditioning, and although he was usually motivated to participate in activities, he started to complain of being tired, was irritable, and had lost weight. John had always suffered from anxiety, however it seemed to be getting worse, and John appeared to be irritable while working at his job at the bakery and library café.

John's caregivers decided to schedule an appointment with the endocrinologist he had seen a few years earlier. Due to John's history the endocrinologist ordered bloodwork and did a clinical examination of John. The neurological exam appeared normal and showed no sign of disease. The following blood work was ordered: a complete blood count

(CBC), comprehensive metabolic panel (CMP), FSH, LH, cortisol, prolactin (PRL), TSH and GH, free T4, and a thyroid antibody test. The endocrinologist also ordered an ultrasound of John's thyroid gland.

The CBC and the CMP were normal. FSH, LH, PRL, GH, thyroid antibody tests, and the cortisol level were also normal, as were the thyroid ultrasound and the thyroid antibody tests. The TSH and T4 were measured and repeated a month later at the same time of day in the early morning and those results are shown below in Table 2.

Table 2. John's endocrine test results.

<i>Endocrine Results March 2023</i>	<i>Result</i>	<i>Normal Range</i>
Free T4	0.9 ng/dL	0.8–1.8 ng/dL
TSH	0.29 uIU/mL	0.40–4.50 uIU/mL
<i>Endocrine Results April 2023 (repeated)</i>		
Free T4	1.0 ng/dL	0.8–1.8 ng/dL
TSH	0.17 uIU/mL	0.40–4.50 uIU/mL

Considering John's history and the fact that he was verbally unable to report his symptoms, the endocrinologist thought it made sense to monitor John's TSH, T4, and total T3 levels in six months. The doctor explained that due to John's autism it was possible that his brain functioned differently regarding hormonal release, and that a low TSH level could be normal for John if his T4 levels stayed within the normal range. However, the doctor also stated that the case presented some clinical uncertainties, and it would make sense to monitor John's thyroid hormones.

Questions

1. In the past, John had deficiency in several pituitary hormones that are released from the anterior pituitary gland. Blood work to check these hormones was ordered again. Give a brief description of these hormones (TSH, LH, FSH, PRL, GH) and how they function in the body.
2. The above hormones are released utilizing the hypophyseal portal system. Describe the structural components of the hypophyseal portal system and state why this portal system is efficient.
3. John's doctor measured cortisol levels early in the morning. What is the basic function of cortisol and why should it be measured early in the morning?
4. When John first visited the endocrinologist, he had an MRI. What condition was ruled out with the results of John's MRI? Why do you think the doctor did not order another MRI for John's current situation?

5. Construct a diagram that shows how the hypothalamus and the pituitary gland interact to stimulate the release of the thyroid hormones via negative feedback.

6. If a person had Grave's disease, a type of hyperthyroidism, would you expect their blood levels of TSH and T₄ to be decreased or elevated? What symptoms would be present? Refer to John's latest test results and consider his levels of T₄ and TSH. Based on John's test results do you think John has Grave's disease? How is Grave's disease treated?

7. Since John's mother has Hashimoto's disease, a type of hypothyroidism, prior to treatment would you expect her blood levels of TSH and T₄ to be decreased or elevated? What are the symptoms associated with hypothyroidism? What could be a treatment for Hashimoto's disease? Do you think John has hypothyroidism?

8. Considering John's current symptoms of sleeplessness, anxiety, and irritability, what hormone(s) could produce these symptoms?

9. Hormones have a wide range of normality, and although the population is distributed across this normal range in a bell-shaped curve, there will be individuals who fall within the lower 25% and upper 25% of any laboratory test. Considering this do you think John would benefit from repeating his blood work in a few months?

10. The endocrinologist will check John's TSH, T₄, and total T₃ in six months to monitor for subclinical hyperthyroidism. What is subclinical hyperthyroidism? Why do you think the endocrinologist wants to measure total T₃ levels?

11. What symptoms might be present with subclinical hyperthyroidism?