

The Baby Who Had No Baby Fat

by

Sheri L. Boyce

Department of Biological Sciences

Messiah University, Mechanicsburg, PA



Part I – Alex Arrives

Twenty-two-year-old Mae tried to relax as the technician placed the ultrasound “wand” on her abdomen and moved it around. She was 35 weeks pregnant and had recently been referred by her local clinic due to concern about low levels of amniotic fluid. The technician said very little during the procedure, other than to tell her the doctor would be in shortly to review the results.

Mae wished Liam could be there with her, but money was tight and they both had been working as many shifts as possible before their son was to arrive. Mae now wished she hadn't put off those early pre-natal visits, but they simply couldn't afford even the small co-pay. Her thoughts of medical bills and how to pay for diapers were interrupted by Dr. Martin's arrival. He was known for his brief, “just the facts” style of conversation and today was no exception.

“Amniotic fluid levels are stable, but his heart rate is still on the high side: 158 bpm at 31 weeks and 150 bpm today. However, he's not gaining weight or growing at the rate he should be. I want to do another ultrasound next week, and if things haven't changed, we'll probably need to induce labor then.” Mae was too stunned to know what questions to ask, and Dr. Martin hurried on to his next patient.

She scheduled another ultrasound, but labor started the day before the appointment. Liam coached her through the contractions, and little Alex was soon placed in her arms. Mae realized she was exhausted and probably not thinking clearly but she was shocked at his appearance. Alex was small as she expected, but he didn't look like a typical newborn. He was shockingly thin with folds of skin that sagged everywhere, and she could easily count his ribs. Where were the rolls of cute baby fat and chubby cheeks that grandmas like to pinch? Why were his eyes bulging so far out of their sockets?

Mae didn't have time to examine Alex further before a nurse whisked him away for a quick exam. Mae overheard staccato murmurs about a heart rate of 200 bpm and a birthweight of only 3.9 pounds. It wasn't long before the nurse informed Mae and Liam that Alex needed to be admitted to the neonatal intensive care unit (NICU) for further care and monitoring.

Question

1. Given Alex's low birthweight, heart rate, and overall appearance, what hormone was likely not present at normal levels during his development? Explain your answer.

Part II – In the NICU

Alex was quickly transferred to the NICU, where neonatologist Dr. Singh considered a number of possible diagnoses. She suspected the problem could be abnormal levels of thyroid hormone, which is a collective term for two separate hormones. Most thyroid hormone is secreted in the form of thyroxine (T₄), which is then converted in the blood and target cells to triiodothyronine (T₃) by removing an iodine atom.

After a heel stick to obtain a blood sample, Dr. Singh reviewed the results and immediately noted that Alex's level of T₄ was 5.4 ng/dL (normal range: 1.1 to 2.3 ng/dL).

Questions

1. Based on the lab results, does Alex have hyperthyroidism or hypothyroidism? How does your answer explain his birth weight and heart rate?

2. Alex's healthcare team proceeded to investigate potential causes of the abnormal thyroid hormone levels. One possibility was a tumor (an adenoma) in the anterior pituitary gland that could disrupt the normal function of the gland. Explain how disruption of normal anterior pituitary gland function could have produced Alex's thyroid hormone levels.

Part IV – A Pre-Existing Condition

The morning after Alex's birth, Dr. Singh arrived in Mae's room. She explained about Alex's hormone levels and then asked a lot of questions about Mae's health before and during her pregnancy. She seemed unsurprised to learn that Mae didn't tolerate heat well and had lost almost 60 pounds in the year before her pregnancy. Mae hadn't intentionally dieted; she had simply assumed that the weight loss was due to the physical activity required by her new job. Mae wondered if the additional 12 pounds she had lost during her pregnancy would have been noted if she had gone for regular pre-natal visits.

Dr. Singh also asked whether Mae had difficulty sleeping, felt anxious or shaky at times, or felt as if her heart was racing.

"Well, yes, sometimes," Mae responded. "But money has been so tight, we're working multiple jobs, and we didn't plan on getting pregnant right away...who wouldn't be stressed?"

Mae looked at Liam, but he appeared as bewildered as she felt. All she really wanted to know was if Alex was going to be okay. Seeing Mae's confusion, Dr. Singh explained that the combination of her significant weight loss, heat intolerance, and physical signs of stress indicated that she might have an autoimmune form of hyperthyroidism known as Graves' disease. If so, that would explain why Alex was so ill.

That afternoon, Mae and Liam visited the NICU. Dr. Singh told Mae that her recent bloodwork confirmed that she had Graves' disease, which had probably been present but undiagnosed for more than a year. Dr. Singh reassured Mae and Liam that although Graves' disease was a life-long condition, it could be treated and an endocrinologist would discuss the options with her.

Dr. Singh smiled. "Even better news is that although Alex's condition is still serious at the moment, the effects of Graves' disease on him should disappear in a few months. In the meantime, we know how to treat him. I think he's going to be just fine."

Questions

1. In Graves' disease, the immune system produces antibodies that trigger excessive production of thyroid hormone. The antibodies can cross the placenta during pregnancy, and produce a form of hyperthyroidism in the infant known as neonatal thyrotoxicosis. What do you think these antibodies bind to in the mother and infant? How would this explain Alex's elevated thyroid hormone and very low TSH?
2. Alex's hyperthyroidism should resolve as the maternal antibodies degrade over the next few months. In the meantime, Dr. Singh administered the following medications. For each medication, give a brief explanation as to why she used it.
 - a. Propranolol:
 - b. Methimazole:
3. Mae was concerned about Alex's bulging eyes, which is a condition called *exophthalmos*. Briefly research the cause of exophthalmos in Graves' disease and write a short explanation. Is this condition likely to be permanent in Alex?