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Short Communication

Hypothyroidism: The Underdiagnosed Metabolic Disorder

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Abstract

Most cases of hypothyroidism (low thyroid function) go undetected because laboratory tests measure only the presence of thyroid hormone in the blood but cannot tell us how much active hormone reaches the bodily tissues that require it for their metabolism. The main function of the thyroid gland is to regulate metabolism. The primary hormone secreted by the thyroid is thyroxine (T4), which is physiologically inactive. T4 has to be converted into its active form, triiodothyronine (T3), in order to exert its effects. This conversion is catalyzed by the action of deiodinase enzymes that are widely distributed throughout most tissues of the body. If insufficient T3 reaches bodily cells, the result is diminished basal metabolism and concomitant hypothyroidism. Low thyroid function is a physiological issue that often escapes detection by hormone blood tests. There is, however, a physiological basal temperature test (BTT) that is 100% reliable in detecting hypothyroidism.

Keywords: *Endocrinology; Thyroid; Metabolism; Hypothyroidism; Triiodothyronine; Thyroxine; Medicine; Physiology*

Introduction

In the 1930s, physiologist Broda Barnes PhD studied the diverse and debilitating symptoms that resulted from thyroidectomizing baby rabbits. Every cell in their bodies was adversely affected by the lack of thyroid hormone. When thyroid hormone was administered to some of the rabbits, there was quick relief for their multiple problems and a seemingly miraculous return to good health [6].

When he became a practicing physician, Broda Barnes MD observed the same symptoms as thyroidectomized rabbits in patients whose thyroid blood tests were normal. In the 1970s, Barnes developed a diagnostic test for hypothyroidism known as the basal temperature t est (BTT) [1]. In his books, Barnes argues that hypothyroidism affects more than 40% of the American population, significantly higher than the prevalence of approximately 5% reported in peer-reviewed medical literature [2, 15].

In 1990, physician Denis Wilson observed that low thyroid symptoms and low body temperatures in the presence of normal thyroid function tests are common due to impaired conversion of thyroxine (T4) to triiodothyronine (T3). Wilson successfully treated these symptoms with sustained-release triiodothyronine (SR-T3) [3].

Body basal temperature measures how efficiently the thyroid gland is functioning, compared to thyroid blood testing which measures only how much hormone is present in the blood but not how active said hormone is. Every metabolic function in the entire body is completely dependent on enzyme function. In turn, enzyme function is highly dependent on bodily temperature. If basal body temperature is below normal, then all enzymes in every cell of the body are under-functioning, thus having a detrimental effect on how efficiently the entire body functions and resulting in many diverse symptoms [10].

Thyroid Function

The main function of the thyroid gland is to regulate metabolism. Thyroxine (T4) is the primary hormone secreted by the thyroid gland. It has the potential to increase the rate of metabolism of most bodily cells and to affect almost all tissues of the body [16]. Thyroxine itself is physiologically inactive, however. It has to be converted to its active form (T3) before it can exert its effects [10].

Triidothyronine (T3) is the physiologically active

form of thyroid hormone. Although some T3 is produced by the thyroid gland, most of it is converted from thyroxine (T4) by the action of deiodinase enzymes distributed throughout most tissues of the body [15]. Active thyroid hormone helps to regulate growth, electrolyte balance, oxidative metabolism, differentiation during cell growth, carbohydrate metabolism, protein metabolism, oxygen consumption, the breakdown of fats, and fertility. Deficiencies of either T4 or T3 are associated with drops in metabolic rate and bodily temperature, increases in cholesterol and blood fats, and accumulation of mucoproteins [10].

Symptoms of Hypothyroidism

Hypothyroidism results from inadequate levels of active thyroid hormone in the body [5, 14]. Symptoms of hypothyroidism vary between individuals and tend to develop slowly [5-11]. Commonly noted symptoms include:

- Diminished basal metabolism
- Low body temperature, especially at bed rest
- Muscles stiff in morning, feel need to limber up
- Fail to feel rested, even after sleeping long hours
- Start slowly in morning, gain speed in afternoon
- Gain weight easily, fail to lose on diets
- Increased blood cholesterol level
- Increased sensitivity to cold temperatures, prefer warm climates
- Physical sluggishness
- Facial puffiness
- Dry skin
- Dry hair or hair loss
- Poor short-term memory, forgetfulness
- Yellowish tint to skin on palms and soles (carotenemia)
- Constipation
- Menstrual irregularity
- These worse at night: coughing, hoarseness, muscle cramps

Undiagnosed Hypothyroidism

By regulating the rate at which metabolic processes take place, the thyroid gland acts as a gatekeeper. Normal thyroid function protects against disease; low thyroid function allows it easy access. As thyroid activity declines, so does immunity, circulation, and almost every bodily function [10]. Some of the many conditions linked to low thyroid function include benign breast disease, cancer, cellulitis, chronic fatigue, depression, eczema, recurrent headaches, infertility, menstrual irregularities, obesity, premature aging, psoriasis, and rheumatic pain [11, 12].

Hypothyroidism is both rampant and underdiagnosed. The main reason it goes undetected is because doctors rely solely on laboratory tests for making their diagnoses. Unfortunately, most people with hypothyroidism have normal levels of thyroxine (T4) circulating in their blood. Their problem is not that that their thyroid glands do not produce enough T4, but rather that their bodily tissues do not convert enough of this hormone into its active form (T3) in order to be able to utilize it efficiently [10, 14].

There is no laboratory test that can determine which cells in the body are receiving adequate thyroid hormone and which are not. The most reliable way we have of assessing thyroid function is to measure its effects on body temperature by means of the basal temperature test (BTT) [10].

Inadequate availability of T3 hormone reduces body temperature and thereby adversely affects the rate at which all biochemical processes take place in the body. This is because temperatures above or below the ideal 37^0C (98.6^0F) alter the shape of enzymes (biochemical facilitators), making them a poorer fit for the substrates for which they were designed [10].

Low levels of T3 reduce body temperature. Low body temperature, in turn, decreases the efficiency at which cells convert T4 into T3, thus putting the body into a conservation mode of reduced capacity. This is a natural form of adaptation in which the body allocates its scarce energy resources only to the most vital functions. Survival becomes the overriding goal. Other activities, such as physical exercise and sex, become a much lower priority [10].

Basal Temperature Test

The basal temperature test (BTT) is an accurate self-test for measuring thyroid function. It is far more reliable than any thyroid blood test. This is because the BTT measures the actual result of the most critical thyroid activity, i.e., the maintenance

of bodily temperature. Blood tests measure only the amount of thyroid hormone circulating in the blood, which may or may not be typical of how much active hormone (T3) gets to the individual cells that need it [10, 13-15].

Bodily temperature is directly related to thyroid activity. 37^0C (98.6^0F) is the ideal temperature at which all biochemical reactions function most efficiently. At temperatures below or above this norm, chemical messengers become misshapen and no longer precisely fit the receptor sites they are intended to activate. Basic physics is at work here, namely heat expands and cool contracts. In this case, however, tolerances are very precise. A shift of temperature of a small fraction of a degree can have a significant effect on the degree of fit between enzyme and substrate, neurotransmitter and receptor, hormone and target cell, and antibody and foreign protein [10].

The basal temperature test (BTT) requires taking an underarm (axillary) temperature reading first thing in the morning while the body is at complete rest. Men, pre-pubescent and post-menopausal women can take this test at any time. Menstruating women need to do the BTT on the second and third mornings after their flow starts [6].

To do the BTT, place an axillary thermometer under the armpit immediately upon awakening and before stirring from bed. Record the reading on two consecutive days. A range of from 36.6^0C to 36.8^0C (97.8^0F to 98.2^0F) suggests normal thyroid function. Temperatures below 36.6^0C (97.8^0F) indicate low thyroid function (hypothyroidism). Temperatures above 36.8^0C (98.2^0F) suggest an overactive thyroid (hyperthyroidism), unless the person has advanced arthritis that could falsely elevate temperature due to muscular contractions [6].

An approximation to the BTT can be made by taking oral temperature readings three times per day between the hours of 10 AM and 5 PM. At the end of the day, average these three readings. Average readings below 37^0C (98.6^0F) suggest hypothyroidism. Readings of 37.3^0C (99.1^0F) or higher suggest either hyperthyroidism, fever caused by infection, or ovulation. Because oral temperatures taken during the day are not strictly related to basal metabolic rate, it is recommended to take oral readings on five consecutive days to rule out extraneous influences [10].

Administration of Triiodothyronine

Triiodothyronine (T3) is the hormone that regulates basal metabolism. If basal metabolism is low, as indicated by either (a) a basal temperature of less than 36.6^0C (97.8^0F), or (b) a consistent daytime temperature of less than 37^0C (98.6^0F), then T3 therapy is required [17].

Triiodothyronine is used in the treatment of hypothyroidism, sometimes in conjunction with thyroxine. Its rapid absorption and short half-life make it more difficult than thyroxine to use in the routine, long-term treatment of hypothyroidism. The starting dose is 20 mcg daily, increasing to a maximum of 60 mcg daily. Unlike thyroxine, which is taken once daily, the larger doses of triiodothyronine are divided into two to three daily doses because of its shorter half-life [18, 19].

Conclusion

Hypothyroidism is the consequence of diminished basal metabolism caused by insufficient active thyroid hormone (triiodothyronine, T3) reaching bodily cells that depend on it for their optimal functioning. Body basal temperature accurately measures the efficiency of thyroid function. If basal temperature is below normal, then all enzymes in every part of the body are under-functioning. Thus, a below normal basal temperature test (BTT) reading is a definitive indicator of hypothyroidism. Oral triiodothyronine is effectively used in the treatment of hypothyroidism, sometimes in conjunction with thyroxine (T4).

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