



Comparative Case Study and Analysis of Aggressive Levothyroxine Treatment vs. Selenium Supplementation for Subclinical Hypothyroidism

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Abstract

Subclinical hypothyroidism, marked by elevated thyroid-stimulating hormone (TSH) levels with normal free thyroxine (T4) levels, often presents subtly with symptoms such as fatigue, weight gain, and mood changes. This case study examines a 44-year-old woman diagnosed with subclinical hypothyroidism and evaluates two treatment approaches: aggressive levothyroxine therapy versus selenium supplementation. Guided by the American Thyroid Association (ATA) and European Thyroid Association (ETA) guidelines, this analysis compares the efficacy, risks, and benefits of both interventions, considering the patient's symptoms, TSH level, and lifestyle. The decision to opt for selenium supplementation aligns with ETA recommendations for patients with mild TSH elevation (below 10 mIU/L) and mild symptoms, aiming to address a mild selenium deficiency and avoid immediate hormone replacement. Follow-up and patient education emphasize dietary modifications, regular physical activity, and close monitoring of thyroid levels to assess treatment efficacy and need for potential escalation. This case underscores the importance of individualized care in subclinical hypothyroidism, highlighting the relevance of patient preferences, biochemical evidence, and lifestyle in achieving effective and sustainable management.

Subject Areas

Applied Biology

Keywords

Subclinical Hypothyroidism, Selenium Supplementation, Levothyroxine Therapy, Thyroid-Stimulating Hormone (TSH), European Thyroid

1. Introduction

Subclinical hypothyroidism, a condition characterized by elevated thyroid-stimulating hormone (TSH) levels with normal free thyroxine (T4), affects approximately 4% - 10% of the general population. While often asymptomatic, this condition can lead to fatigue, weight gain, mood disturbances, and an increased risk of progressing to overt hypothyroidism if left untreated. The condition poses diagnostic and treatment challenges, as the clinical benefits of intervention in mild cases remain debatable.

Previous studies, such as those by Pearce *et al.* and Stott *et al.*, highlight the importance of individualized management strategies, particularly in patients with mild TSH elevation (below 10 mIU/L) [1] [2]. These guidelines emphasize the need to balance the correction of biochemical abnormalities with the risk of overtreatment. This case study applies these principles by comparing two treatment approaches—levothyroxine therapy and selenium supplementation—in a middle-aged woman diagnosed with subclinical hypothyroidism.

2. Case Presentation

The patient, a 44-year-old Asian female, presented to a private clinic with a six-month history of persistent fatigue, slight weight gain, and low energy levels. She described the fatigue as chronic and worsening, significantly affecting her ability to manage daily responsibilities as a schoolteacher. Her low energy levels limited her participation in family activities and hobbies, such as gardening, which she previously enjoyed. She also reported increased irritability and difficulty concentrating, further straining her interpersonal relationships and professional performance. Despite maintaining a balanced diet and exercising regularly, she experienced a gradual weight gain of approximately six pounds during this period.

2.1. Subjective Information

The patient's chief complaint includes persistent fatigue, minor weight gain, and low energy levels over the past six months. She describes fatigue as persistent and affecting her ability to complete daily tasks, with slight improvement on weekends. She reports a minor weight gain of about 6 pounds in six months despite maintaining her usual diet and exercise routine. Her past medical history does not reveal any chronic conditions, and she has no known allergies. Her past surgical history includes a laparoscopic appendectomy at age 32. She has a family history of hypothyroidism on her mother's side, with her mother being diagnosed at age 55. Socially, the patient is married, works as a school teacher, and lives a moderately active lifestyle. She consumes a balanced diet and exercises three times a

week. A review of systems indicates complaints of fatigue, slight weight gain, and irritability but no symptoms of hair loss, dry skin, or constipation.

2.2. Objective Information

On physical examination, the patient's vital signs were within normal limits, with a blood pressure of 120/80 mmHg, a heart rate of 72 beats per minute, and a BMI of 27 kg/m². The thyroid gland was not visibly enlarged on palpation, and there were no palpable nodules. A thyroid function test revealed a TSH level of 6.0 mIU/L (reference range: 0.4 - 4.0 mIU/L) with normal free T4 levels, confirming the diagnosis of subclinical hypothyroidism. The patient's serum selenium levels were also assessed, showing a mild deficiency.

2.3. Clinical Impression

Based on the patient's symptoms, family history, and laboratory results, she was diagnosed with subclinical hypothyroidism. Given the mild nature of her symptoms and the biochemical evidence, there was a consideration between initiating aggressive pharmacologic treatment with levothyroxine or opting for a conservative approach using selenium supplementation and lifestyle modifications.

3. Treatment Options: Levothyroxine vs. Selenium Supplementation

Two key treatment guidelines were considered in determining the most appropriate course of action: those of the American Thyroid Association (ATA) [3] [4] and the European Thyroid Association (ETA) [1]. Both sets of recommendations are supported by substantial evidence; however, their application may differ depending on the patient's clinical presentation, including symptom severity, TSH levels, and underlying risk factors.

3.1. Aggressive Treatment with Levothyroxine

Levothyroxine, a synthetic form of thyroxine (T₄), is commonly used to normalize TSH levels and alleviate symptoms associated with hypothyroidism. The typical initial dosage ranges from 25 to 50 mcg orally once daily, with subsequent adjustments based on TSH values and clinical response. According to Stott *et al.* [2], levothyroxine therapy has demonstrated efficacy in treating subclinical hypothyroidism, particularly in individuals with TSH levels exceeding 10 mIU/L or in those exhibiting clear hypothyroid symptoms. However, the same study reported limited benefits in patients with mildly elevated TSH levels (4.5 - 10 mIU/L) who were asymptomatic or only mildly symptomatic. Potential side effects include palpitations, anxiety, and, in rare instances, bone demineralization or cardiovascular complications if overtreatment occurs. Despite these risks, levothyroxine remains a cost-effective, widely accessible, and well-tolerated option for long-term hypothyroidism management [2] [3].

3.2. Selenium Supplementation and Non-Pharmacologic Approach

Selenium is an essential micronutrient involved in thyroid hormone metabolism, serving as a cofactor for deiodinase enzymes that convert thyroxine (T₄) to the biologically active triiodothyronine (T₃). Selenium deficiency has been associated with thyroid dysfunction, and supplementation may offer benefits for individuals with mild subclinical hypothyroidism. The European Thyroid Association (ETA) guidelines recommend a conservative management approach—including lifestyle modifications and selenium supplementation, for cases with mildly elevated TSH levels (below 10 mIU/L) and minimal symptoms [1]. Selenium is typically supplemented at a dose of 200 mcg per day. In a study by Pirola *et al.* [5], selenium supplementation was shown to reduce TSH levels in patients with subclinical hypothyroidism and mild selenium deficiency, potentially mitigating the risk of progression to overt hypothyroidism. Although generally well-tolerated, excessive selenium intake can cause toxicity, manifesting as gastrointestinal discomfort, alopecia, and nail discoloration. Nonetheless, selenium supplementation is considered a safe, affordable, and non-hormonal treatment option, particularly for patients who are hesitant to initiate levothyroxine therapy.

4. Comparison and Analysis

Both levothyroxine and selenium supplementation represent viable therapeutic options for managing subclinical hypothyroidism, though their appropriateness depends on individual patient factors. Levothyroxine offers the benefit of directly correcting hormonal imbalance and is particularly effective in patients with markedly elevated TSH levels or those experiencing significant symptoms [2]. However, in individuals with only mildly elevated TSH levels (4.5 - 10 mIU/L), the clinical benefits of levothyroxine are less definitive, and overtreatment may be a concern [2]. In contrast, selenium supplementation addresses a possible contributory factor in thyroid dysfunction—micronutrient deficiency—and provides a more conservative treatment pathway that avoids the risks associated with thyroid hormone therapy. While selenium has demonstrated potential, especially in patients with documented deficiency, it may not offer the same rapid symptomatic improvement observed with levothyroxine [1] [6]. Therefore, the choice between these therapies should be individualized, balancing symptom burden, TSH levels, nutritional status, and patient preferences.

The American Thyroid Association (ATA) guidelines provide a structured framework for managing subclinical hypothyroidism. They recommend initiating levothyroxine therapy primarily in individuals with TSH levels above 10 mIU/L or in those experiencing significant symptoms that impair quality of life [2] [3]. For patients with mildly elevated TSH levels (4.5 - 10 mIU/L), the ATA advocates for an individualized approach, taking into account factors such as symptom severity, risk of progression to overt hypothyroidism, and patient preferences [3]. The guidelines emphasize caution to prevent overtreatment, which may lead to adverse outcomes such as osteoporosis or cardiovascular complications associated

with excessive thyroid hormone levels [3]. Furthermore, the ATA does not endorse routine micronutrient supplementation—such as selenium—unless a clinically relevant deficiency is identified [3].

In contrast to the ATA's more interventionist stance, the European Thyroid Association (ETA) promotes a conservative approach, particularly in patients with mildly elevated TSH levels (<10 mIU/L). The ETA recommends lifestyle modifications and selenium supplementation for individuals with mild symptoms and documented selenium deficiency, reserving levothyroxine therapy for more severe biochemical abnormalities or high-risk cases [1]. This guidance is supported by studies indicating that selenium supplementation can help stabilize thyroid function and reduce TSH levels, particularly in cases of autoimmune thyroiditis or marginal selenium deficiency [5].

In the present case, the ETA guidelines were prioritized for several reasons. First, the patient exhibited a mild selenium deficiency, making selenium supplementation a directly applicable intervention consistent with ETA recommendations [1]. Second, the patient's TSH level (6.0 mIU/L) and symptoms—fatigue and slight weight gain—were relatively mild, not justifying immediate hormone replacement therapy according to conservative criteria [1]. Third, avoiding potential adverse effects of levothyroxine, such as cardiovascular complications and osteoporosis, was a significant consideration [5]. Finally, the patient expressed a preference for non-pharmacologic treatment and reluctance to begin long-term hormone therapy, aligning well with the ETA's patient-centered approach [7].

Selenium supplementation was chosen as it addresses a potential underlying contributor to thyroid dysfunction without requiring exogenous hormone administration. Selenium plays a critical role in thyroid hormone metabolism, aiding in the conversion of T4 to the active T3 form and protecting the thyroid gland from oxidative damage [5]. Evidence suggests that supplementation with 200 mcg/day may reduce TSH levels and lower the risk of progression to overt hypothyroidism in patients with mild deficiency [1] [5]. Compared to levothyroxine, selenium supplementation is generally well-tolerated and carries fewer risks, avoiding potential complications such as palpitations, anxiety, and hormone over-replacement [8].

5. Study Limitations and Future Considerations

This study lacks data on the patient's response to selenium supplementation, making it impossible to assess whether the treatment successfully resolved her symptoms and normalized her TSH levels. Without follow-up outcomes, it remains unclear if the chosen intervention adequately addressed the patient's thyroid dysfunction and improved her quality of life. Additionally, the three-month follow-up period is too short to draw definitive conclusions about the long-term efficacy and safety of selenium supplementation. To better understand the treatment's impact, an extended follow-up period of at least one year is recommended. This would allow for more comprehensive monitoring of thyroid function, symptom

resolution, and potential side effects of prolonged selenium use. A longer timeline would also provide a more robust assessment of the sustainability of selenium supplementation as an alternative to levothyroxine.

6. Treatment Decision

Research has shown that selenium supplementation may enhance thyroid function and reduce TSH levels in patients with subclinical hypothyroidism, particularly when selenium deficiency is present. For instance, the SETI study by Pirola *et al.* [5] demonstrated that daily supplementation with 200 mcg of selenium over six months significantly lowered TSH levels and improved thyroid antibody profiles in patients with autoimmune thyroiditis. Similarly, Nascimento *et al.* [6] reported improvements in biochemical markers and reduced inflammatory responses following selenium supplementation in individuals with mild thyroid dysfunction.

These effects are believed to stem from selenium's dual role in thyroid physiology: mitigating oxidative damage and supporting hormone synthesis. By reducing oxidative stress, selenium helps prevent immune-mediated destruction of thyroid tissue—a hallmark of autoimmune thyroiditis—and promotes the stability of thyroid function. In addition, supplementation can correct dietary deficiencies that may exacerbate thyroid dysfunction, particularly in areas with selenium-deficient soils.

Despite its potential, the evidence supporting selenium supplementation for subclinical hypothyroidism has important limitations. Many studies, including those by Pirola *et al.* [5] and Nascimento *et al.* [6], are limited by small sample sizes and short follow-up durations, typically around six months. These constraints limit the generalizability and long-term applicability of their findings. Moreover, the narrow therapeutic window of selenium presents safety concerns; excessive intake can result in toxicity, with side effects such as gastrointestinal disturbances, alopecia, and nail discoloration [8]. Therefore, careful monitoring of selenium status is essential when considering this therapeutic strategy.

The mechanisms by which selenium influences thyroid function are not yet fully elucidated. While its antioxidative properties and role in thyroid hormone metabolism are well established, it remains uncertain whether these benefits apply uniformly across diverse populations or are more pronounced in specific subgroups—such as those with autoimmune thyroiditis or pronounced selenium deficiency [7]. Additionally, some evidence suggests that selenium's therapeutic effect may plateau beyond a certain supplementation threshold, prompting further investigation into optimal dosage and treatment duration [7].

Given these uncertainties, selenium supplementation should be individualized, particularly for patients with confirmed deficiency and mild subclinical hypothyroidism. Its utility as an adjunct rather than a primary therapy is especially relevant in patients who are asymptomatic or have only mild symptoms, as in this case. To refine clinical recommendations, future research should prioritize large-

scale randomized controlled trials with longer follow-up periods to assess the sustainability and safety of selenium's effects on thyroid function and overall patient outcomes.

In this case, selenium supplementation was selected over levothyroxine due to its potential to address the underlying contributor to thyroid dysfunction—mild selenium deficiency—while avoiding the risks of overtreatment. Nevertheless, given the current limitations in the evidence base, careful monitoring of the patient's clinical and biochemical response is essential. This includes periodic thyroid function testing and symptom reassessment to ensure that the intervention remains both effective and safe over time.

Considering the patient's mildly elevated TSH level (6.0 mIU/L), minimal symptoms (fatigue and slight weight gain), and family history of thyroid disease, a conservative strategy was deemed appropriate. Selenium supplementation at a dose of 200 mcg per day was initiated, consistent with ETA guidelines for managing mild subclinical hypothyroidism in the absence of significant symptoms or TSH levels exceeding 10 mIU/L [1]. The patient's documented selenium deficiency further supported this choice [7]. She was also counseled on lifestyle modifications, including a nutrient-rich diet, regular physical activity, and symptom tracking. A follow-up appointment was scheduled in three months to reassess TSH levels and evaluate treatment efficacy.

7. Patient Education and Follow-Up

The patient was educated on the significance of selenium in maintaining thyroid health and the importance of adhering to the prescribed supplementation regimen. She was specifically cautioned against taking additional selenium-containing supplements to avoid the risk of toxicity, which can arise from excessive intake. Ongoing monitoring of thyroid function tests was recommended to assess disease progression and determine whether escalation to levothyroxine therapy might become necessary in the future [8]. A follow-up visit was scheduled for three months to re-evaluate her TSH levels and review any changes in her clinical symptoms.

Cultural and Socioeconomic Considerations

Cultural and socioeconomic factors were carefully considered in developing the treatment plan. The patient's dietary habits and access to selenium-rich foods—such as nuts, seafood, and meats—were reviewed to identify practical strategies for increasing her natural selenium intake. She was provided with educational resources and guidance on affordable food options to support this goal [9]. Additionally, the patient's expressed preference for a conservative management approach, including her hesitation to initiate hormone replacement therapy, was respected and integrated into the treatment strategy. This patient-centered approach not only enhanced adherence but also fostered trust and engagement in her care plan.

8. Conclusion

This case study compared two approaches to managing subclinical hypothyroidism: aggressive treatment with levothyroxine and a conservative approach with selenium supplementation. While both treatments are effective, the decision to opt for selenium was driven by the patient's mild symptoms, moderate elevation of TSH, and the presence of a mild selenium deficiency. This case underscores the importance of individualized treatment plans that consider patient-specific factors, including biochemical evidence, lifestyle, and preferences. Future care should continue to monitor the patient's thyroid function and ensure that the chosen treatment remains effective and safe.

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Conflicts of Interest

The author declares that there is no conflict of interest regarding the publication of this article.

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