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Brown-Red Urinary Sediment as a Rare Macroscopic Finding in a 30-Month-Old Girl with Overt Hypothyroidism: A Case Report

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ABSTRACT

Hypothyroidism in children is a prevalent endocrine disorder characterized by insufficient production of thyroid hormones, significantly impacting physical growth, neurodevelopment, and metabolism. This case report presents a child exhibiting atypical manifestations. A 30-month-old (approximately 2.5 years) girl presented with a chief complaint of brown-red particles in her urine. Initial investigations, including repeated urinalyses and abdominal-pelvic ultrasonography, yielded normal results. Importantly, repeated microscopic examinations of the urine samples revealed no crystals or abnormal cellular elements, confirming that the visible particles were purely macroscopic. Despite treatment for a suspected mild urinary tract infection, the symptom persisted. Growth parameters were within normal limits. Following consultation, thyroid function tests revealed elevated thyroid-stimulating hormone (TSH: 9.09 µIU/mL) and low total thyroxine (T4: 6.4 µg/dL), with normal anti-thyroid peroxidase antibodies, confirming a diagnosis of overt hypothyroidism. Upon diagnosis, levothyroxine therapy was initiated, leading to rapid symptom improvement and complete resolution of the urinary particles within days. This case underscores the importance of considering overt hypothyroidism in children with nonspecific urinary symptoms and highlights the value of meticulous clinical follow-up.

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Introduction

The prevalence of congenital hypothyroidism is approximately 1 in 2,000 to 4,000 live births worldwide, with variations influenced by geographic and ethnic factors. Higher rates are observed in iodine-deficient regions [1]. Major complications of hypothyroidism in children include growth retardation due to impaired bone maturation and decreased growth hormone activity, which can lead to short stature and skeletal malformations. Metabolic disorders, such as prolonged jaundice, hypothermia, and feeding difficulties, arise from disrupted metabolic homeostasis [2, 3]. Cardiovascular complications, including bradycardia and poor circulation, may occur due to reduced thyroid hormone action on cardiac tissue. Neuromuscular disorders, such as hypotonia and delayed motor skills, result from inadequate thyroid hormone signaling during muscle and nerve development [4]. Hearing loss is also linked to untreated congenital hypothyroidism, as thyroid hormones are crucial for the development of the cochlea in the inner ear. In severe cases, hypothyroidism is associated with an increased risk of mortality, often due to respiratory failure or cardiac dysfunction, highlighting the importance of early intervention [5].

While subclinical hypothyroidism (SCH) is frequently discussed in the pediatric literature and is often asymptomatic in young children, overt hypothyroidism—characterized by low circulating thyroxine (T4) levels alongside elevated TSH—presents with more definitive clinical and metabolic manifestations. Importantly, atypical presentations of overt hypothyroidism are increasingly recognized. However, the presence of macroscopic brown-red urinary sediment or particles—in the absence of microscopic crystals—has rarely been reported as a presenting feature. True crystalluria is defined by the identification of specific crystals (e.g., calcium oxalate, uric acid) under microscopy, a finding notably absent in the case presented here.

This case report underscores the importance of considering overt hypothyroidism in children presenting with unusual, nonspecific urinary findings and highlights that meticulous clinical assessment and persistent follow-up are crucial for early diagnosis and timely management.

Case Presentation

A 30-month-old (3-year-old) Persian girl was referred for evaluation of visible brown-red particles in her urine, observed over the preceding weeks. Her history revealed that non-specific symptoms, including fatigue, decreased activity tolerance, and poor appetite, had begun approximately 4 months earlier. At presentation, her height was 87 cm and her weight was 11.6 kg, reflecting a recent loss of 300 grams. She had no dysuria, fever, or abdominal pain. Physical examination was unremarkable, and her growth parameters were within normal limits for her age. All anthropometric measurements were performed by the same trained health professional using a single calibrated scale to minimize measurement error. Written informed consent was obtained from her parents for publication of this case report.

Initially, her mother (a nurse) increased the child's fluid intake, suspecting dehydration, without resolution. Subsequently, the mother modified the child's diet to exclude pigmented foods and supplements, but the particles persisted. Given ongoing concern, multiple urine samples (urinalysis/urine culture, UA/UC) were collected over several days. Importantly, the laboratory specialist confirmed the absence of any crystals or abnormal cellular elements under repeated microscopic examinations, emphasizing that the particles were purely macroscopic (visible to the naked eye). During the diagnostic workup, consultations with various physicians raised the possibility that these particles might represent excreted metabolites of medications or supplements. To investigate this hypothesis, the mother discontinued all the child's supplements; however, the particles persisted unchanged, ruling out supplement-derived pigments as the causative factor. Notably, the standard urinalysis results were otherwise normal, showing no hematuria, pyuria, or bacteriuria. The initial urine dipstick analysis revealed a pH of 6.0 and a specific gravity of 1.017, both within the normal reference range for age. These parameters remained essentially unchanged on subsequent repeated urinalyses and were therefore not serially reported. A complete abdominal and pelvic ultrasound was also normal.

The parents then consulted a pediatrician who, after reviewing the normal investigations, reassured them of the child's health, noting that another child of similar age had recently been evaluated with normal results. Despite this reassurance, the mother sought a second opinion. Consequently, the child was referred to a pediatric nephrologist who suspected a genital fungal infection and prescribed topical clotrimazole. This treatment showed no effect over 1.5 months.

Following persistent follow-up, further tests

revealed mild microcytic anemia (hemoglobin: 10.5 g/dL, mean corpuscular volume (MCV): 77.3 fL). Thalassemia minor was investigated and ruled out. Finally, at the mother's specific request, thyroid function tests were performed. These showed elevated thyroid-stimulating hormone (TSH) at 9.09 µIU/mL (normal: 0.5–4.5) and low total thyroxine (T4) at 6.4 µg/dL, confirming overt hypothyroidism. Anti-thyroid peroxidase (Anti-TPO) antibodies were negative.

The child was referred to an endocrinologist and started on levothyroxine. Remarkably, the urinary particles disappeared completely within one week of treatment initiation. There is a family history of hypothyroidism on both parental sides. The mother had gestational hypothyroidism during both pregnancies, treated with levothyroxine. The child had a positive qualitative heel-prick test for congenital hypothyroidism at birth, but a follow-up quantitative test was normal, and no further monitoring was advised. She was born at term with a birth weight of 3.2 kg and length of 50 cm. She received routine vaccinations and showed normal growth patterns during health center visits.

The patient has been regularly followed up for over 25 months since diagnosis. At the age of 55 months (approximately 4.5 years), she remains on a stable dose of levothyroxine (50 µg/day, administered 5 days per week). Her current growth parameters are within the normal range for her age, with a weight of 16.5 kg and height of 104 cm. The macroscopic urinary particles have not recurred, and her thyroid function tests have remained within normal limits on treatment. The serial anthropometric and laboratory data are summarized in Table 1.

Discussion

The diagnosis of hypothyroidism in children can be challenging, particularly when the presenting features are atypical. While classic symptoms such as growth retardation, constipation, and dry skin are well-recognized, nonspecific urinary findings—such as macroscopic brown-red particles in the urine—have been infrequently reported. Importantly, in the present case, repeated microscopic examinations of the urine samples revealed no crystals or cellular elements, confirming that the particles were purely macroscopic (visible to the naked eye) and distinct from true crystalluria. This case report describes a 30-month-old (approximately 2.5 years) girl in whom these macroscopic urinary particles were the initial manifestation of overt hypothyroidism, with rapid resolution following levothyroxine therapy. This report underscores the importance of recognizing unusual and isolated findings for the early diagnosis of overt hypothyroidism in children.

A study by Léger et al. (2014) demonstrated that 20% of children with SCH exhibited nonspecific symptoms, including fatigue, decreased appetite, and behavioral changes; however, macroscopic urinary sediment/particles were not included among the reported symptoms [6]. Metwalley and Farghaly (2024) noted that hypothyroidism may be linked to renal metabolic disorders; however, the precise mechanism underlying its association with macroscopic urinary particles remains unclear. This case is particularly unique in that these macroscopic particles emerged as the primary symptom, without any evident developmental or metabolic symptoms, warranting further investigation in future studies [5]. Shamekhi Amiri's (2020) study found that urinary changes associated with hypothyroidism are due to impaired

Table 1. Serial anthropometric and laboratory findings during diagnosis and follow-up of overt hypothyroidism in a 30-month-old (approximately 2.5 years) girl.

Age (months)	Height (cm)	Weight (kg)	TSH (µIU/mL)	T4	Anti-TPO (IU/mL)	Hemoglobin (g/dL)	MCV (fL)
28 (at diagnosis)	87	11.6	9.09	6.4	20.3	10.5	77.3
30	88.5	12.4	5.38	Not measured	Not measured	10.4	83.2
35	90.5	12.4	0.47	Not measured	Not measured	10.5	74.8
37	92.5	12.6	2.47	Not measured	Not measured	10.6	75.3
42	95.5	13.4	2.72	Not measured	Not measured	11.2	78.4
55 (latest follow-up)	104	16.2	1.9	Not measured	Not measured	11.5	77.8

renal tubular function. These findings support the hypothesis of a connection between macroscopic urinary particles and hypothyroidism [6].

Regarding the delay in diagnosis in the present case, it can be attributed to the normal results of the initial urine tests and imaging studies. As Léger et al. (2014) have noted, overt hypothyroidism with a TSH level below 10 µIU/mL may be overlooked during routine screening [6,7]. In the present case, an improvement in macroscopic urinary particles was observed approximately one week after the initiation of levothyroxine treatment, indicating a rapid response to therapy. Although the precise mechanism of these macroscopic particles in overt hypothyroidism remains unclear, several hypotheses warrant consideration: 1) impaired renal tubular metabolic handling of waste products due to reduced thyroid hormone-dependent enzyme activity, as thyroid hormones directly regulate the expression of key tubular transporters such as Na^+/K^+-ATPase and Na-Pi cotransporters (8, 9); 2) alterations in urine pH and the consequent solubility of various organic and inorganic substances, given that hypothyroidism has been shown to impair urinary acidification—particularly in the distal tubule—leading to a higher minimum urine pH and reduced ammonium excretion (10); 3) changes in the composition or concentration of urinary mucoproteins, such as Tamm-Horsfall protein, which may affect particle aggregation and has been implicated in the modulation of crystal retention [11]; and 4) possible effects of thyroid hormone deficiency on renal blood flow and glomerular filtration rate, which could alter the concentration of solutes, as reduced cardiac output in hypothyroidism leads to decreased renal perfusion and a significant reduction in GFR [12]. These hypotheses, while speculative, provide a framework for future investigations into the pathophysiology of this unusual manifestation.

The strengths of this report include the comprehensive documentation of the diagnostic and therapeutic course, as well as the regular follow-up and recording of the child's response to treatment. The diagnostic odyssey in this case highlights a critical teaching point. The initial presentation was deemed insignificant by the first pediatrician, partly due to a coincidental encounter with another healthy child of similar age. This underscores how non-classical presentations can lead to diagnostic oversight. The mother's persistence as a healthcare professional was pivotal in pursuing the diagnosis. This case emphasizes that clinicians should maintain a high index of suspicion for endocrine disorders even when symptoms are isolated, non-specific, or coincidentally downplayed by comparative encounters.

Conclusion

This case highlights macroscopic brown-red urinary sediment—in which repeated microscopic examinations revealed no crystals—as a rare but potential presenting sign of overt hypothyroidism in children. It underscores the importance of considering thyroid dysfunction in the differential diagnosis of unexplained urinary findings, even in the absence of classic symptoms. Further studies are needed to elucidate the underlying pathophysiology of this association.

Ethical Considerations

Ethical Statement

This case report was approved by the Ethics Committee of Golestan University of Medical Sciences (ethical code: IR.GOUMS.REC.1404.135). Written informed consent was obtained from the child's parents for the publication of this case report and any accompanying clinical details

Limitations

The main limitation of this report is the lack of definitive crystallographic analysis to determine the exact composition of the urinary particles. While drug metabolites or exogenous pigments were considered in the differential diagnosis, the rapid and complete resolution of the macroscopic urinary particles within one week of initiating levothyroxine therapy strongly argues against these etiologies and supports a direct link with overt hypothyroidism. Nevertheless, as a single case report, it cannot establish causality, and further prospective studies are warranted

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Conflict of Interests

The authors have no conflict of interest to declare.

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