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Nephrology

A CASE OF UNEXPLAINED RENAL FAILURE IN A YOUNG CHILD

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ABSTRACT Acute lymphoblastic leukemia (ALL) is a common pediatric malignancy, though its presentation with acute kidney injury (AKI) and spontaneous tumor lysis syndrome (TLS) is rare and presents significant clinical challenges. We report the case of a 10-year-old boy who presented with bilateral cervical lymphadenopathy, hypertension, and renal impairment. Initially treated conservatively at a local hospital, his condition deteriorated, leading to referral to our center. On further evaluation, the patient exhibited decreased urine output, weight loss, night sweats, and worsening renal function. Laboratory findings revealed AKI and hyperuricemia, raising suspicion of spontaneous TLS. Subsequent diagnostic workup, including bone marrow aspiration, biopsy, and flow cytometry, confirmed ALL with aleukemic features—characterized by the absence of circulating blasts in peripheral blood. The patient was managed with allopurinol, aggressive hydration, and, following hematology consultation, chemotherapy initiation at an oncological center. This case highlights the challenges in diagnosing and managing ALL with AKI and spontaneous TLS, emphasizing the importance of early recognition and multidisciplinary care to address rapidly progressing metabolic disturbances.

KEYWORDS :

INTRODUCTION

Acute lymphoblastic leukemia (ALL) is the most prevalent pediatric cancer, accounting for approximately 25% of childhood malignancies. Although ALL primarily involves the bone marrow and blood, it can present with systemic manifestations, including renal complications. These renal issues are typically secondary to chemotherapy, such as tumor lysis syndrome (TLS) or drug-induced nephrotoxicity. However, primary renal involvement, particularly manifesting as acute kidney injury (AKI), is rare and can significantly delay the diagnosis of underlying leukemia [1,2].

Spontaneous TLS, which occurs in the absence of chemotherapy, is an oncological emergency characterized by the abrupt release of intracellular contents (such as potassium, phosphate, and uric acid) due to rapid tumor cell turnover and lysis. This leads to severe metabolic abnormalities and, in some cases, acute renal failure. Though spontaneous TLS is rare in ALL, it can develop in cases with a high tumor burden or rapid cell proliferation, necessitating early detection and prompt intervention to prevent life-threatening complications [3].

Our case report describes a child with ALL who presented with AKI and hyperuricemia, indicative of spontaneous TLS. It underscores the critical importance of considering malignancy in pediatric patients with unexplained renal failure and metabolic disturbances.

Case Presentation

Master G.S., a 10-year-old boy from Shillong, Meghalaya, was initially admitted to a local hospital with a two-week history of bilateral neck swelling, vomiting, and two episodes of generalized tonic-clonic seizures (GTCS). Upon admission, he was found to have severely elevated blood pressure, measuring 190/100 mmHg, and laboratory tests revealed renal impairment with a serum creatinine level of 2 mg/dL. Despite conservative management, including antihypertensive treatment, his condition showed no signs of improvement, leading to his referral to our centre for further evaluation and advanced management.

Upon presentation to the tertiary care hospital, the patient's mother reported a history of reduced urine output, significant fatigue, and a weight loss of 3 kg over the preceding two weeks, accounting for over 10% of his body weight. She also noted recent-onset snoring and night sweats. There had been no further episodes of seizures, and the child's medical, familial, and socioeconomic history was unremarkable. He was fully vaccinated according to the Indian Academy of Pediatrics (IAP) schedule and had no history of easy bruising, prolonged bleeding, recurrent infections, bone pain, or fever. Additionally, there was no history of rash, joint pain, alopecia, lymphadenopathy, or failure to thrive and developmental history was also normal.

On general examination, the blood pressure was elevated at 160/80 mmHg. A detailed physical examination revealed bilateral cervical lymphadenopathy. The right cervical lymph node measured 5x5 cm, while the left measured 4x3 cm. Both nodes were firm, non-tender, mobile, and non-adherent to the surrounding tissues, with no signs of erythema or warmth, suggesting the absence of active infection or inflammation. Cardiovascular examination revealed normal heart sounds with no murmurs or additional sounds. Respiratory examination showed clear lung fields bilaterally with no wheezing, crackles, or other abnormal breath sounds. The gastrointestinal system was also unremarkable, with a soft, non-tender abdomen and no hepatosplenomegaly. Neurological examination revealed no focal deficits, with the child being alert, oriented, and without signs of cranial nerve involvement or motor weakness.

The Complete Blood Count (CBC) revealed a total white blood cell count of 12,110 cells/mm^3, which was within normal limits. Hemoglobin levels were 14.8 g/dL, indicating no immediate evidence of anemia. Serum uric acid levels were markedly elevated at 13.3 mg/dL. Peripheral blood smear did not show any abnormal cels or blasts. Following aggressive intravenous hydration, serum creatinine levels showed improvement, decreasing from an initial 1.65 mg/dL to 1.3 mg/dL. Serum electrolytes, including sodium, potassium, chloride, and bicarbonate, as well as arterial blood gas analysis and phosphorus levels, were all within normal ranges. A urinalysis showed trace proteinuria, without the presence of red blood cells or pus cells, ruling out hematuria or urinary tract infection. These findings reinforced our our suspicion of spontaneous TLS and renal involvement secondary to an underlying hematologic malignancy.

We further went ahead with imagine studies, and ultrasound revealed bilateral nephromegaly with preserved corticomedullary differentiation, without signs of structural damage or chronic disease. High-resolution CT of the thorax showed thymic hyperplasia, but no mediastinal mass or lymphadenopathy was noted. Renal Doppler ultrasound demonstrated normal renal artery flow with no evidence of stenosis or vascular abnormalities. Additionally, a brain MRI/MRA was performed due to the history of seizures, and both were normal, showing no intracranial lesions, vascular anomalies, or other abnormalities, effectively ruling out central nervous system

involvement or hypertensive encephalopathy as contributing factors.

Given the high suspicion of tumor lysis syndrome (TLS) and an underlying hematologic malignancy, a bone marrow study was performed. Bone marrow aspiration revealed significant replacement of normal hematopoietic elements by atypical mononuclear cells, comprising 70% of the total cellularity, consistent with blast infiltration typical of acute leukemia. Bone marrow biopsy demonstrated diffuse infiltration by immature lymphoid cells with scant cytoplasm and hypochromatic nuclei, further supporting the diagnosis of acute leukemia. (Figure 1)

Flow cytometry confirmed the presence of T-cell markers, including CD5+, CD8+, CD4+, and cytoplasmic CD3+ (CyCD3+), indicating T-cell acute lymphoblastic leukemia (T-ALL) and establishing the specific immunophenotype of the disease.

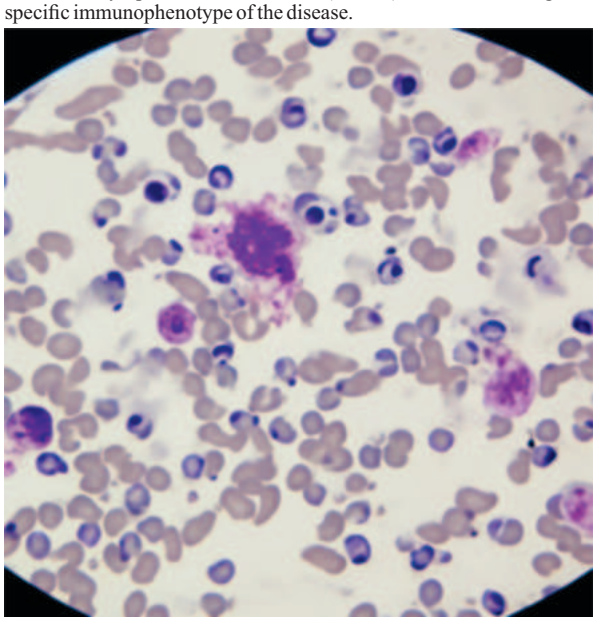

Figure 1: Bone Marrow Aspiration

The patient was definitively diagnosed with aleukemic acute lymphoblastic leukemia (ALL) based on the results of bone marrow aspiration, biopsy, and flow cytometry. Additionally, the presence of hyperuricemia, acute kidney injury (AKI), and encephalopathy pointed to spontaneous tumor lysis syndrome (TLS), likely driven by the high tumor burden of ALL. This explained his renal dysfunction and metabolic disturbances. He was promptly started on allopurinol to manage hyperuricemia and received aggressive intravenous hydration to preserve renal function. After a hematology consultation, the patient was transferred to a specialized paediatric oncological center for the initiation of chemotherapy and comprehensive management.

DISCUSSION

Renal involvement in acute lymphoblastic leukemia (ALL) is relatively common, but the presentation of ALL with acute kidney injury (AKI) and hyperuricemia as primary symptoms is exceptionally rare. This case highlights a unique presentation in which the patient first exhibited signs of renal failure and metabolic disturbances before the typical hematologic manifestations of leukemia emerged. In this context, hyperuricemia, a hallmark of tumor lysis syndrome (TLS), served as a critical indicator, raising suspicion for an underlying malignancy.

Tumor lysis syndrome (TLS) is a well-recognized complication in aggressive malignancies such as ALL and typically occurs following the initiation of chemotherapy. However, spontaneous TLS, which arises in the absence of treatment, is far less common and is usually associated with tumors exhibiting high proliferative rates or significant tumor burdens. In spontaneous TLS, the rapid turnover of malignant cells leads to the release of intracellular contents, including potassium, phosphate, and uric acid, resulting in potentially life-threatening metabolic derangements, such as AKI and electrolyte imbalances [4].

Several cases in the literature have documented similar presentations. Suh et al. (2007) reported a case of ALL presenting with AKI and hyperuricemia, which resolved after chemotherapy, highlighting the rare nature of renal involvement as an initial symptom [5]. Bhatia et al. (2013) also described paediatric cases in which renal failure was the first clinical sign of ALL, with hyperuricemia and elevated lactate dehydrogenase (LDH) serving as pivotal diagnostic markers [6]. These reports emphasize the importance of considering malignancy in children presenting with unexplained renal failure, particularly when associated with hyperuricemia and other metabolic abnormalities.

Renal enlargement is another significant finding in ALL, noted in approximately 24% of cases. Studies suggest that nephromegaly in ALL correlates with a shorter first remission duration and poorer event-free survival, underscoring the prognostic significance of renal involvement in this malignancy [7].

In this case, the absence of peripheral blasts, coupled with AKI and hyperuricemia, made the diagnosis of ALL particularly challenging. Ultimately, bone marrow aspiration and biopsy were crucial in confirming the diagnosis. Aleukemic leukemia, characterized by the lack of detectable blasts in peripheral blood, is a rare form of leukemia that requires a high degree of clinical suspicion for early and accurate diagnosis [8].

CONCLUSION

This case underscores the importance of recognizing early metabolic abnormalities, such as hyperuricemia and acute kidney injury (AKI), as potential indicators of underlying malignancies, including acute lymphoblastic leukemia (ALL). When unexplained renal failure and metabolic derangements occur, spontaneous tumor lysis syndrome (TLS) should be strongly considered, even in the absence of typical hematologic signs like circulating blasts. The absence of peripheral blood abnormalities, as seen in aleukemic presentations, can delay diagnosis, making bone marrow aspiration and biopsy essential for confirming leukemia. Early identification and prompt intervention, including the management of TLS, are critical for preventing irreversible renal damage and improving overall prognosis in patients with ALL. This case highlights the need for vigilance in paediatric patients with unusual presentations of renal impairment and metabolic disturbances, ensuring timely and appropriate oncological treatment.

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