International Journal of Emergency Medicine

CASE REPORT

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A case of acute tubulointerstitial nephritis following the use of chenopodium album L

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Abstract

Introduction Chenopodium album, commonly known as "lambsquarters," is a plant consumed as food and used in traditional medicine. Its popularity is increasing due to the belief that it has fewer side effects compared to synthetic drugs. However, its use can lead to acute or chronic poisoning. The growing interest in herbal remedies, along with uncontrolled usage and disregard for expert recommendations, contributes to adverse effects.

Case Presentation : A 68-year-old female patient presented to the emergency department with nausea, vomiting, and flank pain following the use of lambsquarters. Impaired kidney function was detected in the patient. A biopsy performed after Chenopodium album usage led to the diagnosis of tubulointerstitial nephritis (TIN). The patient responded positively to corticosteroid and hemodialysis treatment.

Discussion Caution is necessary in the use of herbal medicines and traditional treatments. A thorough evaluation of factors such as patients' nutritional status, herbal product usage, medication history, and genetic background is crucial. Chenopodium album can cause tubulointerstitial nephritis, resulting in kidney damage. Similarly, heavy metal poisoning through herbal products can lead to kidney damage. Adopting a multidisciplinary approach in the diagnosis and treatment process can contribute to better patient management.

Conclusion This case presents a rare instance of tubulointerstitial nephritis developed due to the use of herbal products. Physicians should inquire about patients' history of exogenous substance use and conduct a comprehensive assessment, keeping such situations in mind. Conscious use of herbal medicines and traditional treatments can help prevent serious complications like kidney damage.

Keywords Chenopodium album, Acute tubulointerstitial nephritis, Herbal supplements, Renal dysfunction, Side effects

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Introduction

Chenopodium album, also known colloquially as "lambsquarters" (Fig. 1), is a plant widely consumed as food in many cultures and utilized in certain traditional medical practices. This herbal food has been gaining popularity, attributed to the belief that herbal medicines have fewer side effects compared to synthetic drugs [1]. However, its use can significantly contribute to incidents of acute or chronic poisoning. Poison control centers admit over 100,000 patients exposed to toxic plants, with the majority involving minor toxicities related to the ingestion of medicinal plants in small quantities. In most severe poisoning cases, individuals consume a toxic plant either accidentally or with the intention of utilizing its therapeutic properties [2]. In recent years, the increasing interest in herbal remedies, uncontrolled usage of herbal products, and the disregard for recommendations from healthcare professionals prior to use have exacerbated the negative effects associated with these products [3]. An estimated one-third of adults in developed countries and over 80% of the population in many low- and middle-income countries use herbal and traditional medicines to enhance health or treat common illnesses. Herbal medicines can lead to kidney damage due to toxicity, contamination, misidentification, mislabeling, and adverse plant-drug interactions. The kidneys are particularly sensitive to toxic damage due to their high blood flow, extensive endothelial surface area, high metabolic activity, active uptake by tubular cells, medullary interstitial concentration, and low urine pH. Kidney damage can manifest as nephrolithiasis, chronic interstitial fibrosis, uroepithelial cancer, crystalluria, or hypertension, with some plants increasing potassium levels in those with kidney damage. The regulation of herbal and traditional medicines by global health organizations is critical to reduce the risk of acute kidney injury or chronic kidney disease associated with plant consumption. Nephrologists should be aware of potential nephrotoxicity arising from herbal medicines and supplements [4]. Additionally, some studies indicate that patients using alternative medicines may experience complications such as acute kidney injury (AKI) due to heavy metal poisoning. Defining the use of traditional herbal medicines as a source of toxicity can be challenging [5]. Tubulointerstitial nephritis (TIN) is a condition that can lead to chronic kidney disease (CKD), a common cause of kidney damage. TIN progresses to fibrosis in the renal interstitium through immune-mediated inflammation by inflammatory cells. Patients may present with nonspecific symptoms, and delays in the diagnosis and treatment of the disease can occur if not suspected. Etiologically, drugs, infectious agents, toxins, idiopathic causes, genetic factors, inflammatory bowel disease, or systemic inflammatory conditions associated with immunoglobulin G4 (IgG4) may lead to TIN. Clinical suspicion for TIN is necessary for diagnosis and treatment. Treatment depends on the underlying etiology, with corticosteroids forming the cornerstone of therapy [6]. In this case, a patient who used Chenopodium album for weight loss and experienced impaired kidney function was diagnosed with ATIN following a kidney biopsy. The patient benefited from corticosteroid and hemodialysis treatment. A literature review revealed that this is the first reported case of ATIN following the use of Chenopodium album.

Fig. 1 Coltsfoot (Chenopodium album) is widely used in alternative medicine

Case presentation

A 68-year-old female patient presented to the emergency department with complaints of nausea, vomiting, and flank pain. She reported a history of using lambsquarters for weight loss for seven consecutive days two weeks prior. The patient had no chronic diseases except for diabetes mellitus and was taking metformin 500 mg/day. Upon admission, her vital signs were stable (temperature: 36.2 °C, blood pressure: 129/71 mm Hg, respiratory rate: 18/min, pulse rate: 88/min), and physical examination revealed findings such as arthralgia, edema, and rash. Laboratory investigations showed elevated serum blood urea nitrogen (BUN) at 40.4 mg/dL, creatinine at 2.84 mg/dL, and potassium at 6.1 meq/L. The complete urine analysis indicated leukocytes, leukocyte casts, and erythrocytes (Table 1), (Fig. 2). Two months ago, the serum creatinine was 0.82 mg/dL, and a renal ultrasound showed no abnormalities except for a grade 2 increase in bilateral parenchymal echoes. The patient was admitted to the nephrology clinic for further investigation of the etiology of acute kidney failure and initiation of treatment. On the first day of follow-up, despite medical treatment, hemodialysis was initiated due to persistently high potassium levels (Fig. 3). Following hemodialysis, a kidney biopsy was planned, performed, and pathology consultation was sought. The light microscopy of the kidney biopsy, evaluated with four glomeruli, revealed sclerosis in two glomeruli, thickening of the Bowman capsule in one glomerulus, tubular atrophy, interstitial fibrosis, and mononuclear inflammatory cell infiltration with dense eosinophils in the interstitium. Immunofluorescence showed no deposits (Fig. 3). Given the clinical indications of tubulointerstitial nephritis (TIN), corticosteroid therapy at a dose of 80 mg/day was initiated (Fig. 4). The

Table 1 Laboratory monitoring

Laboratory Parameters and Days	1st Day	2nd Day	3rd Day	4th Day	5th Day	7th Day	9th Day	Post-discharge Follow-up
BUN, mg/dl	40,4	56	64	71	55	51	38	19
Creatinine, mg/dL	2,84	3,48	3,89	3,6	2,33	1,9	1,3	0,89
eGFR, ml/min: (Estimated Glomerular Filtration Rate, ml/min)	21	16,5	13,8	12	21,02	28,1	43,2	67,2
Sodium, mEq/L	140	140	137	135	134	138	137	140
Potassium, mEq/L	6,14	6,8	5,0	5,01	3,4	4,2	3,7	4,3
Proteinuria, g.	0,74			0,08				0,13
Complete Urinalysis	Leu 100 Wbc 52 Eritrosit: 33			Leu: negative Wbc:1 Eritrosit :3				Leu: negative Wbc:1 Eritroist:0
Urine Culture	No microbial growth was detected."							
Complement 3/4	157/30,5							
Anti PLA2R	Normal							
AST/ALT	18/12	10/15	13/26	17/29	11/16	10/17	15/19	12/17
Total Bilirubin/Direct Bilirubin	0,3/0,14	0,2/0,09	0,15/0,09	0,1/01	0,28/0,14	0,24/0,11	0,32/0,11	0,3/1,7
WBC	9,2	8,7	9,1	8,2	8,9	12	8,1	5,3
Hemoglobin	12,2	12	10,6	10,9	11,4	10,9	11,2	11,8
Platelet	263	256	273	240	288	309	277	321
Free Kappa/Lambda	1,41/1,99							
Hemoglobin A1C	6,07							6,91
ANA, Anti Ds DNA, ANCA Profili: ANA (Antinuclear Antibody), Anti Ds DNA, ANCA (Antineutrophil Cytoplasmic Antibody) Profile	Normal							
Hepatit A, B, C ve HİV	Negative							
IgG, IgA, IgM, IgE Levels	Normal							
Blood Gas (pH/ HCO3-)	7,3 / 14	7,46/19	7,43/20	7,37/19	7,41/20	7,39/21	7,43/19	7,4/18
FENa	2%							
IgG4 Level	0,445							
C-Reactive Protein	4,4			5			3	2
Procalcitonin	0,2			0,17			0,15	0,12

CRP: C-Reactive Protein, BUN: Blood Urea Nitrogen, eGFR: Estimated Glomerular Filtration Rate, C3, C4: Complement 3,4 Levels, Anti-PLa2R: Phospholipase A2 Receptor Antibody, AST: Aspartate Transaminase, ALT: Alanine Transaminase, WBC: White Blood Cell, FENa: Fractional Sodium Excretion

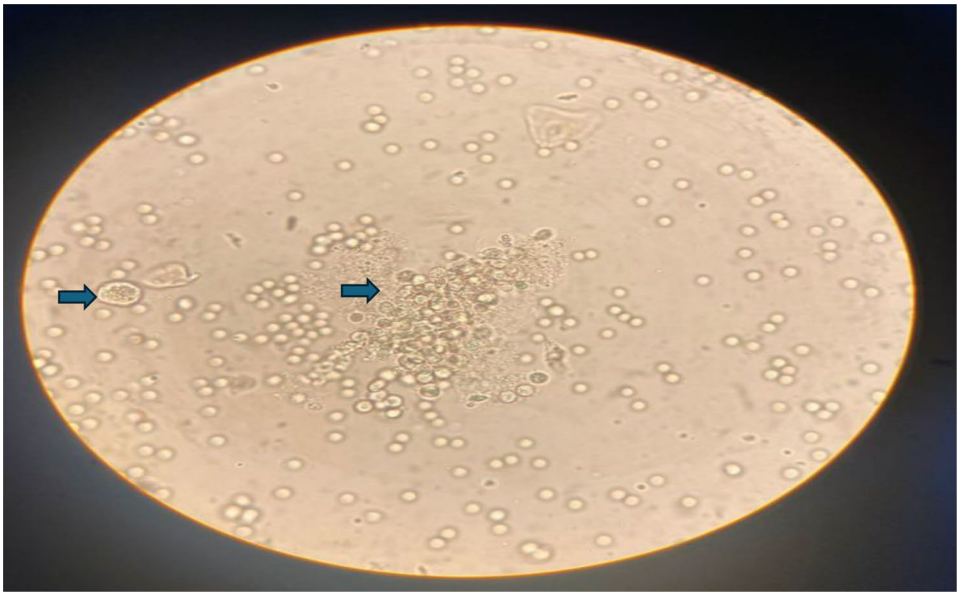

Fig. 2 Leukocytes, leukocyte casts, and clusters of erythrocytes in urine sediment under the light microscope

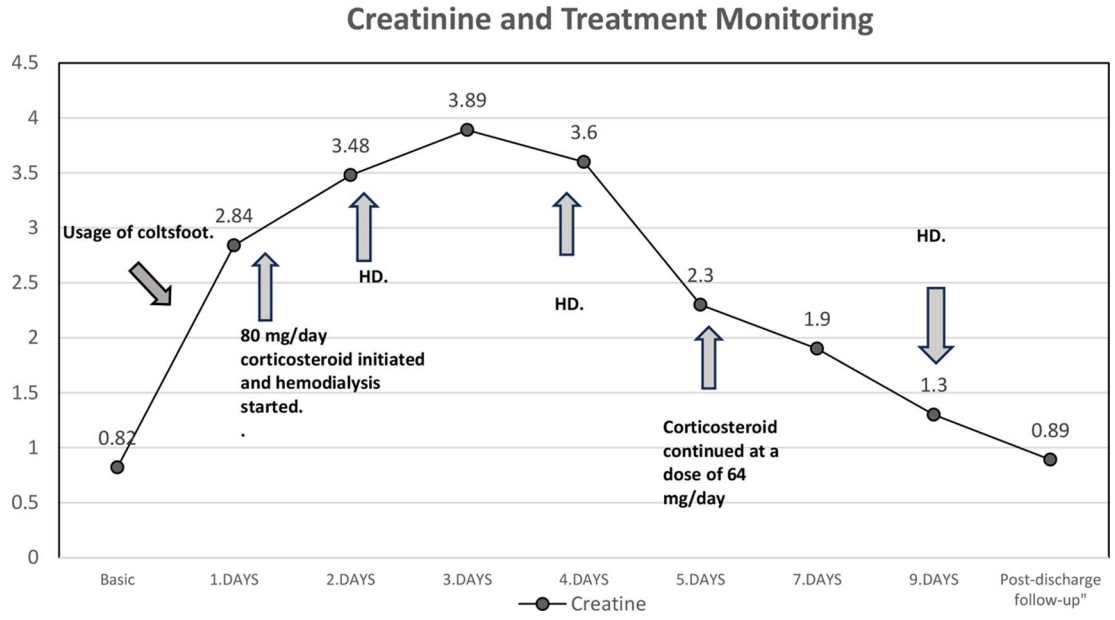

Fig. 3 Renal function and treatment course. **HD**: Hemodialysis

patient's metformin, used for diabetes, was discontinued, and insulin therapy was initiated. The patient underwent hemodialysis on the 2nd and 4th days of follow-up, continuing the same dose of steroid therapy. On the fifth day, evaluation revealed a decrease in creatinine levels to 2.33 mg/dL and a reduction in nausea and vomiting symptoms (Fig. 4), (Table 1). The temporary hemodialysis catheter was removed after hemodialysis, and steroid therapy continued at a dose of 64 mg/day. On the 11th day of follow-up, with no remaining complaints, the steroid dose was reduced by 16 mg to 48 mg/day. Linagliptin was initiated for diabetes regulation, and the patient was discharged for outpatient follow-up. Upon returning for a checkup five days later, her creatinine levels had returned to baseline at 0.89 mg/dL (Table 1). Steroid dosage was gradually reduced during follow-ups and discontinued over four weeks.

Discussion

We presented in detail a case of AIN that emerged in a patient who consumed Chenopodium album for one week. To the best of our knowledge, this report represents the first such case in the literature. There are many cases of kidney failure in the clinical setting with

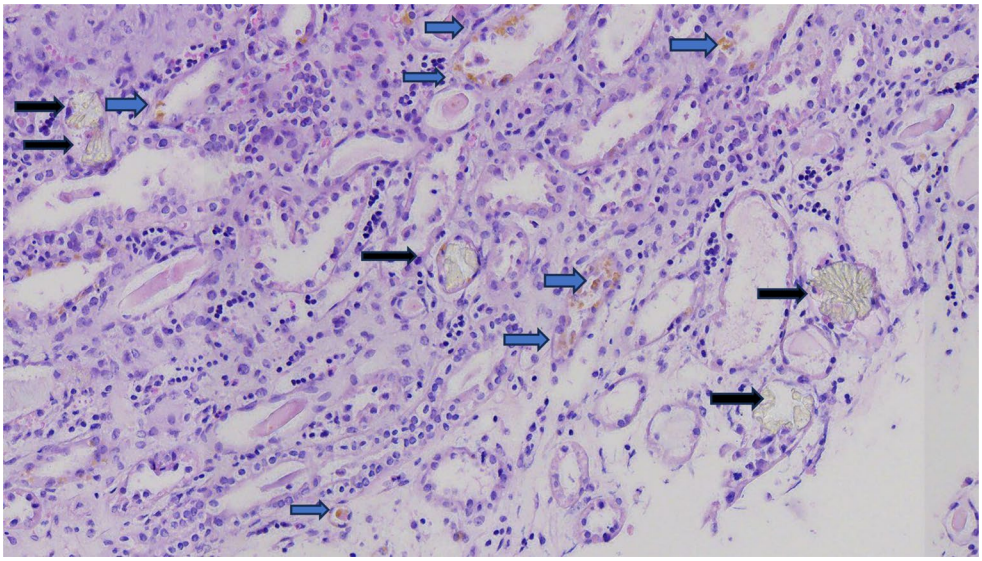

Fig. 4 Black arrows indicate crystals in renal tubules, while blue arrows demonstrate hemosiderin accumulation in renal tubule epithelium under light microscopy. (H&E, × 200)

unexplained etiology. This case emphasizes the importance of careful use of medications, including herbal medicines and traditional treatments. It highlights the necessity for healthcare professionals to obtain a comprehensive history, including factors such as nutritional status, herbal product usage, medication history, and genetic background, to understand the patient's condition better. Moreover, it underscores the need for further research on the side effects of herbal products.

Chenopodium album is known to be consumed in various regions of the world, believed to have protective effects against hepatotoxicity induced by carbon tetrachloride according to animal experiments [7–9]. However, there is insufficient research on its side effects, interactions with drugs, and the potential for contamination with heavy metals.

AIN is usually confirmed when histological findings such as interstitial inflammation, edema, and tubulitis accompany acute kidney injury (AKI). The etiology of AIN is diverse, with known causes including drugs, various infections, autoimmune or systemic diseases, and idiopathic conditions. Several studies have shown that drugs are the most common etiology of AIN. Furthermore, AIN reported after the intake of herbal medicines has been documented [10]. In our case, the presence of findings such as tubular atrophy, interstitial fibrosis, and mononuclear inflammatory cell infiltration with dense eosinophils in the interstitium led to the diagnosis of AIN (Fig. 3).

The pathogenesis of AIN typically involves allergic reactions triggered by exposure to a specific drug. T-cell-mediated hypersensitivity reactions and cytotoxic T-cell injuries play a role in the pathogenesis of AIN [11]. The exact disease mechanism leading to AIN caused by Chenopodium album is not clear based on the current data. Additionally, the kidneys are a sensitive organ to heavy metal poisoning, which can occur due to both acute and chronic exposure. Heavy metals taken into the body can lead to kidney lesions such as acute tubular necrosis, cortical necrosis, and interstitial nephritis. Exposure to heavy metals, both acutely and chronically, can cause tubulointerstitial injuries without any marked morphological changes, and these can manifest within days after exposure to the toxic substance. Heavy metal exposure constitutes a significant yet inadequately understood cause of kidney damage. The pathology findings, including crystals seen in the tubules, suggest this possibility. However, the absence of symptoms commonly observed in heavy metal poisoning cases, such as encephalopathy, seizures, mental status changes, papilledema, ataxia, and abdominal pain, makes this diagnosis challenging [12, 13].

The cornerstone of AIN treatment is discontinuation of the suspected nephrotoxic agent. There is a general consensus that when there is no evidence of improvement in kidney function after 5–7 days following the discontinuation of the suspected toxin, treatment, especially with steroids initiated promptly, may be beneficial. The rationale for this approach is that early corticosteroids may reduce the inflammatory infiltration of the renal interstitium and thereby prevent later fibrosis risk [11, 14]. In our case, a thorough evaluation of history, physical examination, laboratory, and pathological findings led to the initiation of steroid therapy, combined with hemodialysis due to electrolyte disturbances, acidosis, and uremic symptoms, resulting in a positive outcome.

In conclusion, we aimed to provide a multidisciplinary perspective on the diagnosis and management of AIN following the use of herbal products through this case. Physicians should inquire about the history of exogenous substance use and conduct a comprehensive assessment, keeping such situations in mind. Conscious use of herbal medicines and traditional treatments can help prevent serious complications like kidney damage.

Acknowledgements
Not applicable.

Author contributions
Author Contributions: Alparslan Demiray (A.D.): Designed the manuscript, followed the patient, and wrote the article. Tugba Yılmaz (T.Y.): Conducted the literature review and contributed to the writing of the article. Ismail Koçyiğit (İ.K.): Contributed to the conceptualization of the article, patient follow-up, and provided assistance in ensuring the academic strength of the manuscript. Pathological evaluation was performed by Sevil Demiray (S.D.) and Hülya Akgün (H.A.). H.A. conducted the examination of the kidney biopsy, and S.D. made significant contributions to this examination process, contributing significantly to the academic richness of the article.

Funding
This study received no financial support.

Data availability
No datasets were generated or analysed during the current study.

Declarations

Ethics approval and participant consent
Ethical approval and participant consent not applicable for this case report.

Consent for publication
Written informed consent was obtained from the patient for the publication of this case report.

Competing interests
The authors declare no competing interests.

Received: 20 March 2024 / Accepted: 7 December 2024
Published online: 18 December 2024

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