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A Case Report of Chronic Kidney Disease Stage 5 Complicated with Uremic Tumor Calcinosis

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Abstract

Uremic tumor calcinosis (UTC) represents an extremely rare complication associated with chronic kidney disease (CKD), prominently characterized by the occurrence of ectopic calcification. The incidence of UTC among uremic peritoneal dialysis patients has been estimated to be approximately 1.60%. This specific case report aims to illuminate the intricate diagnostic and therapeutic challenges encountered in a dialysis patient. A 74-year-old male, diagnosed with stage 5 CKD and undergoing peritoneal dialysis, presented with a considerable 12x5 cm soft tissue mass on his back. Through a comprehensive array of imaging studies and histopathological examinations, the mass was subsequently identified as UTC. The diagnostic process revealed elevated levels of Parathyroid hormone (PTH) at 445.100 pg/ml and phosphorus at 2.77mg/dl. The diagnosis was ultimately confirmed via surgical resection. The patient's condition was managed and stabilized through the administration of phosphate binders and calcitriol. This case significantly underlines the critical necessity of vigilant and continuous monitoring of calcium-phosphorus metabolism in patients with CKD. Furthermore, it highlights UTC as an important differential diagnosis consideration when confronted with soft tissue masses.

Keywords: Uremic Tumor Calcinosis, stage 5 Chronic Kidney Disease, treatment, surgical resection

1. Introduction

Uremic Tumor Calcinosis (UTC) constitutes an extremely rare complication that is closely associated with stage 5 Chronic Kidney Disease (CKD). The prevalence of UTC among dialysis patients ranges from 0.5 to 3.0%[1]. In the domestic media sphere, relatively few reports on Uremic tumor calcinosis cases can be found. The majority of the available literature mainly consists of individual case reports[10][11][12]. Uremic tumor calcinosis is characterized by the existence of ectopic calcification, which emerges as a direct consequence of disordered calcium-phosphorus metabolism[2]. In the context of stage 5 chronic kidney disease, prolonged secondary hyperparathyroidism leads to parathyroid gland hyperplasia. This specific phenomenon, in turn, markedly aggravates the state of hyperparathyroidism and induces a severe disturbance in the calcium-phosphate homeostasis. The underlying mechanisms implicated in this process are intricate and interrelated, giving rise to a series of physiological imbalances that have profound implications for overall health and normal bodily functions. The increase of the calcium-phosphate product ($Ca \times P > 55$ mg^2/dL^2)[3], along with impaired renal excretion capacity, further promotes metastatic calcifications. Eventually, this series of events results in uremic toxicities.

The question that prominently emerges is precisely why Uremic tumor calcinosis is more frequently witnessed in dialysis patients and how the implementation of early detection can potentially result in significantly improved treatment outcomes. It is notable that patients diagnosed with stage 5 chronic kidney disease, especially those undergoing dialysis, frequently encounter a notable compensatory hyperplasia of the parathyroid glands. This particular phenomenon subsequently gives rise to a substantial increase in the secretion of parathyroid hormone and the subsequent development of hyperparathyroidism[4]. As a consequence, the metabolism of calcium and phosphorus undergoes a profoundly significant disturbance, thereby playing a crucial role in contributing to the formation of calcinosis, specifically manifesting in the form of Uremic tumor calcinosis. The diagnosis of Uremic tumor calcinosis is rendered challenging on account of its rarity and the resemblance it presents to other calcific disorders. Furthermore, the treatment options accessible for Uremic tumor calcinosis remain limited and lack standardized protocols.

This report presents a rare case of Uremic tumor calcinosis in an atypical location, namely the back, in a patient undergoing peritoneal dialysis. It offers valuable insights into the variable manifestations and management strategies of Uremic tumor calcinosis. By elaborating on the diagnostic process and therapeutic outcomes, as well as exploring the efficacy of diverse treatment plans in dealing with Uremic tumor calcinosis, this case report aims to bridge the gap in the existing literature by providing a comprehensive and detailed account of the diagnostic process and the treatment approach adopted for Uremic tumor calcinosis in patients with chronic kidney disease stage.

2. Clinical Data

(1) Basic Patient Information and Data

The patient is a 74-year-old male. Foamy urine has persisted for over 22 years, and he was diagnosed with chronic renal failure 7 years ago. Regular peritoneal dialysis has been administered for 3 years. He was admitted to the hospital on February 8, 2022, on account of a mass on the right side of his back for 3 months. The daily dialysis protocol is automated peritoneal dialysis with 1.5% low-calcium peritoneal dialysis solution (4 bags), featuring an ultrafiltration of approximately 1000 ml per day and no urine output. The patient has a history of hypertension (grade 3, extremely high risk) for over 23 years and ischemic heart disease. He has been on aspirin and other medications for a prolonged period. One of his younger brothers and one of his younger sisters both have uremia and are undergoing hemodialysis treatment.

(2) Physical Examination

A mass on the right back has been detectable for 3 months. Initially, its dimensions were approximately 3 by 2 centimeters. Over time, the size of this mass has been continuously increasing. Furthermore, it is accompanied by a feeling of pain; yet, there is no sign of fever. Specifically, there is a subcutaneous mass on the outer side of the right scapula, which measures approximately 12 by 5 centimeters. When touched lightly, it is tender. There is no manifestation of redness or swelling. The boundary of the mass is clear, and its texture is hard.

(3) Laboratory Tests

Meticulously conducted laboratory tests disclosed specific and detailed values. The parathyroid hormone (PTH) level was precisely determined as 445.100 pg/ml, a figure of significant implications. The phosphorus level was accurately ascertained at 2.77mg/dl, and the calcium level was precisely recorded at 2.1 mg/dl. These results, presented with clarity and precision, offered highly critical and indispensable information concerning the patient's internal physiological conditions. Such data was of the utmost significance in forming a comprehensive understanding of the patient's health status and would play a vital role in guiding subsequent medical decisions and treatment plans.

(4) Color Doppler Ultrasound Report

Upon admission, an ultrasound examination, specifically Color Doppler ultrasound, was conducted. The findings revealed a mixed echogenic mass approximately measuring 12 x 5.1 x 2.6 cm in size, located beneath the right scapula. The margins of the mass were well-defined, yet its shape was irregular. The internal echogenicity predominantly exhibited medium to low echoes with heterogeneous features. Furthermore, there were areas of high echo and irregular echo patterns present. Notably, Color Doppler Flow Imaging (CDFI) failed to detect any significant blood flow signals within the mass.

(5) The chest Computed Tomography (CT)

A CT scan was conducted and it furnished more elaborate and detailed information. It clearly indicated the presence of a mass with a mixed density composition, characterized by both high and low attenuation within the subcutaneous tissue of the right lower chest wall. The lesion not only manifested within the subcutaneous tissue but also extended into the intercostal space. The boundaries of this lesion were well-defined and distinct. Fortunately, upon close examination, no significant abnormalities were detected in the adjacent bone structures. The precise measurements of the mass were approximately 110 x 70 x 34 cm, providing a comprehensive and thorough understanding of its size and exact location, which was of great significance for subsequent diagnosis and treatment planning.

Table 1. Laboratory and Imaging Findings

Parameter	**Value**	Normal Range
PTH	445.1pg/ml	15-65pg/ml

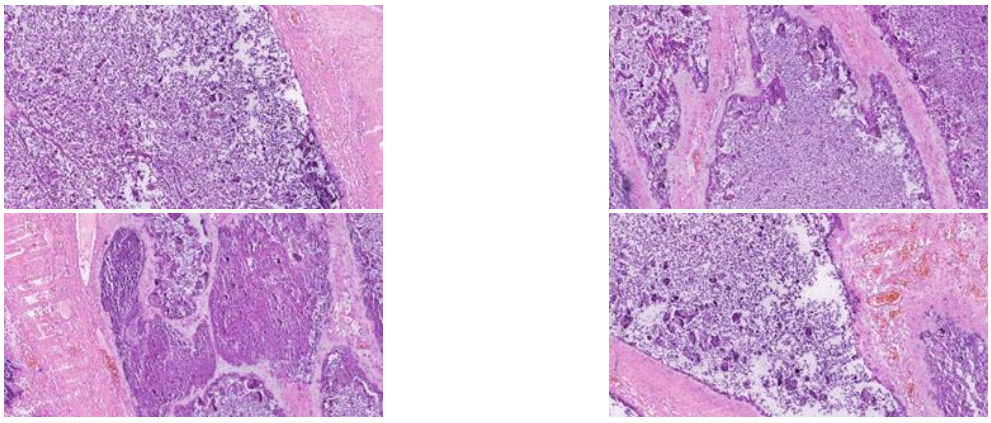
P	2.77mg/dl	0.7-1.7mmol/l
Ca	2.1mg/dl	2.1-2.9mmol/l
Ultrasound	Mixed echogenic mass	-
CT	Mixed density shadows of high and low density in a mass-like pattern can be seen in the subcutaneous tissue of the chest wall.	-

(6) The Selection of Treatment Plans

In light of the considerable size of the patient's tumor and the markedly elevated levels of PTH and phosphorus, which are closely related to the disorder of calcium metabolism in uremia, we carried out a meticulous and comprehensive analysis to deliberately select a well-rounded treatment plan. This plan mainly comprised surgical intervention, which was regarded as indispensable for directly addressing the tumor problem. Furthermore, precise regulation of calcium and phosphorus metabolism was of utmost significance. This involved close surveillance of the patient's dietary intake and the administration of appropriate medications to maintain the equilibrium of these minerals within the body. Additionally, targeted treatment of secondary hyperparathyroidism was incorporated into the plan. This involved the utilization of specific drugs and therapeutic measures aimed at rectifying the hyperactivity of the parathyroid glands. The pharmacological treatment regime encompasses alfacalcidol at a dosage of 1.0 microgram daily and lanthanum carbonate at a dose of 1 gram per meal. These medications were chosen based on their verified efficacy and safety profiles in comparable cases, and their dosages were determined after meticulous consideration of the patient's individual condition and response to treatment. Close follow-up and regular monitoring of the patient's progress were also planned to guarantee the effectiveness of the treatment and to make any requisite adjustments.

(7) Surgical resection removed a 12x5x3 cm mass, with histopathology confirming UTC

- **Intraoperative findings:** The incision, which was made along the dermatoglyphic direction of the tumor surface, measured approximately 14 cm in length. Both the skin and the underlying subcutaneous tissue were precisely incised. It was clearly observed that the tumor was located on the deep surface of the right latissimus dorsi muscle within the chest wall. The dimensions of the tumor were approximately 12 x 5 x 3 cm. The tumor was positioned in close proximity to the lateral edge of the erector spinae muscle and adjacent to the rib surface. Notably, its pedicle extended into the intercostal space. Through meticulous surgical procedures, the tumor was successfully and completely excised.
- **Pathological findings:** A tissue specimen measuring 12.5 x 8 x 3 cm exhibited cystic and solid characteristics upon sectioning, containing fine gray-yellow tissue.
- **Pathological conclusion:** Significant calcification and granulomatous reaction were identified in relation to the right chest wall. Considering the patient's history of nephropathy, these findings are consistent with secondary tumoral-like calcification (refer to Figure 1).



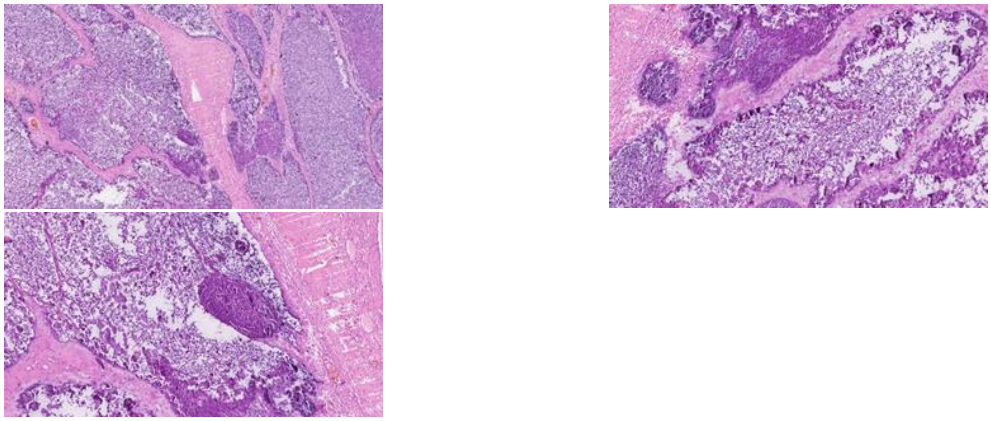


Figure 1. Pathological diagnosis: (right chest wall) significant calcification and granuloma reaction were found. Combined with the history of nephropathy, it was consistent with secondary tumor like calcification

3. Discussion

Uremic tumor calcinosis is a distinct form of calcium deposition that can be categorized into idiopathic, metastatic, and dystrophic types[13]. Metastatic calcinosis is frequently a consequence of metabolic disorders involving calcium and phosphorus, particularly in cases of chronic renal insufficiency. The clinical manifestations typically present as subcutaneous nodules of varying sizes, which may subsequently adhere to the skin, exhibit tenderness, and ultimately develop into a substance resembling lime. The incidence of UTC among patients undergoing uremic peritoneal dialysis is approximately 1.60%[3]. It is easy to be mistaken for orthopedic tumors. The lesions are often found in the soft tissues around the hip, shoulder, elbow and other major negative joints. In severe cases, it will lead to joint stiffness, limited activity, and neurovascular compression. Lesions typically manifest in the soft tissues surrounding major joints, such as the hip, shoulder, and elbow joints[5], The pathogenesis of UTC is still unclear. Among uremic patients, most scholars believe that it is related to the increase of calcium and phosphorus products caused by secondary hyperparathyroidism in uremic patients. A high calcium-phosphorus product and elevated parathyroid hormone levels are regarded as the most significant factors contributing to the development of UTC[4]. The diagnosis of UTC primarily relies on imaging studies and pathological evaluation. In clinical practice, it is particularly important to differentiate UTC from calciphylaxis—a rare but potentially fatal condition characterized by microvascular calcification predominantly affecting the media of subcutaneous microvessels. Pathological features include media calcification along with secondary intimal fibrosis and thrombosis. Histopathological examination serves as the gold standard for diagnosing calciphylaxis; affected vessels typically range in diameter from 40 to 600 micrometers[5][6][7][8]. Currently, treatment options for tumoral calcinosis mainly encompass pharmacological interventions aimed at inhibiting secondary hyperparathyroidism, correcting disturbances in calcium and phosphorus metabolism, and surgical resection of tumors[6][9].

At present, there is no standardized treatment plan for Uremic tumor calcinosis treatment. Several reports have said that its treatment plan is effective, but the number of sample cases is small, and there is a lack of evidence-based medical evidence. The treatment approach for UTC is classified into medical and surgical modalities[10]. Comprehensive medical treatment strategies involve sufficient dialysis, precise control of hyperphosphatemia, maintaining blood calcium and phosphorus at the lower limit of the target range, as well as effective control of elevated parathyroid hormone (PTH), among others. For patients with a significant increase in PTH levels, proactive surgical intervention on the parathyroid gland is suggested, which includes parathyroidectomy (PTX) and parathyroid radiofrequency ablation (RFA). Generally, surgical removal of the mass is not the initial preferred treatment choice. Once the mass is removed, several problems may occur, such as a high risk of recurrence, secondary infections, and difficulties in wound healing. However, in cases where comprehensive medical treatment is ineffective and UTC significantly affects the patient's quality of life, accompanied by joint pain and restricted mobility near the mass, surgical removal can be considered. Additionally, there are case reports indicating the complete disappearance of UTC masses after successful kidney transplantation.

This case of Uremic Currently, it is strikingly obvious that there is a distinct lack of a standardized and unanimously accepted treatment protocol for Uremic tumor calcinosis. A considerable number of reports have indeed indicated that certain treatment plans could potentially demonstrate effectiveness; however, it is essential to note that the quantity of sample cases encompassed is rather restricted. Furthermore, there exists a profoundly

significant deficiency in the domain of evidence-based medical evidence. At present, the treatment approaches for tumor-like calcinosis primarily encompass drug-based inhibition of secondary hyperparathyroidism, meticulous correction of calcium and phosphorus metabolism disorders, precise surgical resection of tumors when it is deemed necessary[13], and in certain circumstances, kidney transplantation. These treatment modalities are typically utilized in accordance with the specific conditions and requirements of individual patients. The selection and implementation of the appropriate treatment method necessitate comprehensive consideration of a wide array of factors such as the patient's overall health status, the severity and nature of the disease, as well as potential risks and benefits. Moreover, the process of determining the most suitable treatment option often involves in-depth evaluations by medical experts, who take into account not only the immediate symptoms but also the patient's long-term prognosis and quality of life. Additionally, continuous research and clinical trials are ongoing to enhance the understanding and efficacy of these treatment modalities, with the aim of establishing more effective and standardized treatment protocols in the future.

This case of Uremic tumor calcinosis in a stage 5 CKD patient highlights its atypical presentation on the back, contrasting with joint-adjacent locations in prior reports. Diagnostic confirmation relied on elevated PTH and phosphorus levels, supported by histopathology showing calcification and granulomas, distinguishing UTC from calcification defense, which affects smaller vessels and has higher mortality. Treatment with alfacalcidol (1.0 mcg daily), lanthanum carbonate (1 g with meals), and surgical resection stabilized the patient, At the six-month follow-up, there was no evidence of tumor recurrence，with PTH normalizing to 172.6 pg/ml at 6 months, and blood phosphorus levels returned to a normal range of 1.68 mmol/L. This case indicates that clinicians should consider the possibility of UTC in patients with CKD who present with soft tissue masses. Early imaging and metabolic monitoring are essential for facilitating timely intervention. The current treatment strategy for UTC is determined by factors such as tumor size, parathyroid hormone levels, and calcium and phosphorus concentrations. For smaller tumors, pharmacological therapy may serve as the primary treatment approach. Future clinical data will be essential for the development of standardized treatment guidelines. Sum up from this case,UTC is associated with inadequate dialysis, prolonged hyperphosphatemia, secondary hyperparathyroidism, and elevated levels of C-reactive protein. Enhancing the adequacy of dialysis and implementing standardized treatment protocols for SHPT can effectively prevent the onset of UTC. Parathyroidectomy and radiofrequency ablation have been shown to be beneficial in promoting the dissolution or disappearance of the mass. Appropriate pharmacological management combined with long-term follow-up monitoring post-surgery is essential to ensure therapeutic efficacy and mitigate the risk of recurrence.

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