

Penile Necrosis in a Patient With End-Stage Kidney Disease: Suspected Uremic Calciphylaxis in the Setting of Severe Peripheral Arterial Disease

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Abstract

Uremic calciphylaxis, also known as calcific uremic arteriolopathy, is a rare and potentially fatal complication of advanced kidney disease. Penile involvement is uncommon and may result in progressive tissue necrosis. In patients with end-stage kidney disease, penile necrosis may have multiple contributing etiologies, including calciphylaxis, severe peripheral arterial disease, diabetic vasculopathy, and infection.

A 68-year-old man with end-stage kidney disease receiving continuous ambulatory peritoneal dialysis, longstanding diabetes mellitus, severe peripheral arterial disease, profound hypoalbuminemia, and abnormalities in mineral metabolism presented with extensive necrosis involving the penis, left hemiscrotum, and lower extremities. Laboratory evaluation demonstrated severe hypoalbuminemia, hyperphosphatemia, hypocalcemia, anemia, and leukocytosis. A sputum culture grew extended-spectrum β -lactamase (ESBL)-producing *Klebsiella pneumoniae*, while a urine culture grew ESBL-producing *Escherichia coli*. These microbiological findings documented respiratory and urinary isolates, respectively, but did not establish infection of the necrotic genital or lower-extremity tissues. The patient underwent right above-knee amputation and total penectomy with perineal urethrostomy. Despite surgical removal of grossly necrotic tissue, ischemic changes persisted, followed by amputation stump wound dehiscence, hemodynamic deterioration, septic shock, acute respiratory failure, and death.

The coexistence of end-stage kidney disease requiring peritoneal dialysis, longstanding diabetes mellitus, severe peripheral arterial disease, profound hypoalbuminemia, mineral abnormalities, and multisite tissue necrosis raised substantial clinical suspicion for uremic calciphylaxis. However, the absence of histopathological confirmation, documented radiological evidence of vascular calcification, and intact parathyroid hormone measurement precluded a definitive diagnosis. The tissue necrosis was considered multifactorial, with severe peripheral arterial disease, diabetic vasculopathy, infection, and suspected uremic calciphylaxis representing potential contributors.

Categories: Urology, Nephrology, Cardiac/Thoracic/Vascular Surgery

Keywords: calcific uremic arteriolopathy (cua), calciphylaxis, end-stage kidney disease, penile necrosis, peripheral arterial disease (pad), peritoneal dialysis (pd)

Introduction

Calciphylaxis, also known as calcific uremic arteriolopathy, is an uncommon but potentially fatal complication of advanced chronic kidney disease. It is characterized by vascular calcification, endothelial dysfunction, thrombosis, and progressive impairment of tissue perfusion, which may result in ischemia and necrosis [1,2]. The condition occurs predominantly in patients with end-stage kidney disease and is associated with several risk factors, including diabetes mellitus, hypoalbuminemia, hyperphosphatemia, hyperparathyroidism, and warfarin exposure [1-3].

Penile involvement is an uncommon manifestation of calciphylaxis and has been described primarily in patients with end-stage kidney disease and diabetes mellitus. It may occur in association with ischemic necrosis involving other anatomical sites [4-6]. However, penile necrosis in patients with end-stage kidney disease should not be attributed automatically to calciphylaxis, as severe peripheral arterial disease, diabetic vasculopathy, and infection may produce similar clinical findings or contribute concurrently to tissue injury [5]. Diagnosis can be challenging because there is no single diagnostic test, and histopathological confirmation may not always be feasible, particularly when tissue is severely compromised [2,7].

Management of suspected calciphylaxis is multidisciplinary and may include optimization of dialysis and mineral metabolism, nutritional and wound care, analgesia, treatment of infection, and selected surgical intervention [1,2]. Sodium thiosulfate is frequently used off-label, although evidence supporting its efficacy

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remains limited, particularly in patients receiving peritoneal dialysis [2,8,9]. Surgical treatment of penile necrosis may range from conservative management to debridement, partial penectomy, or total penectomy, depending on the extent of necrosis, vascular status, infection, and the patient's overall clinical condition [4,5,10].

We present a case of suspected uremic calciphylaxis in a patient with end-stage kidney disease receiving peritoneal dialysis, longstanding diabetes mellitus, severe peripheral arterial disease, and extensive penile and lower-extremity necrosis. The patient underwent right above-knee amputation and total penectomy with perineal urethrostomy and subsequently developed persistent ischemic injury, wound complications, septic shock, and death.

Case Presentation

A 68-year-old man with a four-year history of end-stage kidney disease receiving kidney replacement therapy with continuous ambulatory peritoneal dialysis since October 2024 was evaluated.

His medical history was significant for type 2 diabetes mellitus of 31 years' duration, treated with insulin glargine 14 IU once daily; hypertension of 11 years' duration, treated with valsartan; and an acute myocardial infarction three years earlier, for which he underwent cardiac catheterization. Information regarding stent placement was unavailable. His medications included acetylsalicylic acid 100 mg once daily, clopidogrel 75 mg once daily, and atorvastatin 20 mg nightly.

Regarding his renal history, in October 2024, the patient had been hospitalized for acute worsening of chronic kidney disease without subsequent recovery of renal function, initially requiring hemodialysis. A Tenckhoff catheter was placed that same month. He subsequently continued continuous ambulatory peritoneal dialysis with four daily exchanges using 2.5% dialysis solution at 08:00, 12:00, 16:00, and 20:00, with the peritoneal cavity left dry overnight. During hospitalization, he received sevelamer 800 mg, two tablets every eight hours with meals, and erythropoietin 4,000 IU on Mondays, Wednesdays, and Fridays.

The patient had a history of tobacco use beginning at 30 years of age, with consumption of approximately one pack per day, which he discontinued 10 years before admission. He also reported consuming approximately 3 L of beer daily beginning at 30 years of age; this was discontinued 15 years before admission. He denied the use of other substances, drug allergies, or a history of blood transfusions. There was no documented history of treatment with warfarin or other systemic anticoagulants. He was receiving antiplatelet therapy with acetylsalicylic acid and clopidogrel because of his cardiovascular history.

The patient presented to the emergency department on Day 1 with marked deterioration in his neurological and overall clinical status. The exact onset of the genital and extremity lesions could not be established because of his neurological impairment at admission. The severity of pain could also not be adequately assessed because of his neurological status. The lesions were initially described as dry necrosis.

On physical examination, the patient was in poor general condition, with mucocutaneous pallor, dehydration, and a Glasgow Coma Scale score of 11. Examination of the lower extremities revealed dry necrosis involving the second, third, and fourth toes of the right foot and a necrotic lesion involving the left heel, in the setting of severe peripheral arterial disease and diabetes mellitus. Genitourinary examination revealed established necrosis of the glans penis and left hemiscrotum (Figure 1).



FIGURE 1: Penile and Left Hemiscrotal Necrosis

Clinical photograph demonstrating established necrosis involving the glans penis and left hemiscrotum.

Initial laboratory studies showed a serum creatinine level of 9.6 mg/dL, serum urea level of 166 mg/dL, blood urea nitrogen of 77.57 mg/dL, hemoglobin of 7.7 g/dL, leukocyte count of $22.17 \times 10^3/\mu\text{L}$ with neutrophilia, and platelet count of $781 \times 10^3/\mu\text{L}$. Hyponatremia and hypochloremia were also present, with sodium and chloride levels of 128 mmol/L and 84 mmol/L, respectively. Troponin was 54.4 ng/L, creatine kinase was 318 U/L, and CK-MB was 27 U/L (Table [1](#)). A blood gas analysis was subsequently obtained as part of the evaluation of the metabolic disturbance; however, the type of blood sample was not documented in the available medical record.

Laboratory Panel	Laboratory Test	Patient Value	Unit	Reference Range
Complete blood count	Hemoglobin	7.7	g/dL	13.5–17.5 g/dL (adult male)
	Hematocrit	21.7	%	41–53% (adult male)
	Platelets	781	$\times 10^3/\mu\text{L}$	150–400 $\times 10^3/\mu\text{L}$
	White blood cell count	22.17	$\times 10^3/\mu\text{L}$	4.0–11.0 $\times 10^3/\mu\text{L}$
	Absolute neutrophils	20.76	$\times 10^3/\mu\text{L}$	1.5–7.5 $\times 10^3/\mu\text{L}$
Blood chemistry	Glucose	114	mg/dL	70–99 mg/dL (fasting; fasting status not documented)
	Urea	166	mg/dL	Approx. 15–40 mg/dL; laboratory-dependent
	Blood urea nitrogen	77.57	mg/dL	7–20 mg/dL
Serum electrolytes	Serum creatinine	9.6	mg/dL	0.7–1.3 mg/dL (adult; interpretation differs in ESKD)
	Sodium	128	mmol/L	135–145 mmol/L
	Chloride	84	mmol/L	98–107 mmol/L
Cardiac biomarker	Troponin	54.4	ng/L	Assay-specific; verify institutional 99th-percentile upper reference limit
	Creatine kinase	318	U/L	Approx. 30–200 U/L; laboratory-dependent
	Creatine kinase-MB	27	U/L	Assay-specific; verify institutional reference interval
Blood gas	pH	7.39		7.35–7.45 (interpretation depends on sample type; type not documented)
	Standard bicarbonate	21.8	mmol/L	22–26 mmol/L
	Lactate	1	mmol/L	0.5–2.0 mmol/L

TABLE 1: Selected Laboratory Findings on Day 1

Laboratory findings obtained on Day 1, including hematologic, biochemical, electrolyte, cardiac biomarker, and blood gas parameters relevant to the clinical presentation. Patient values are presented with their corresponding units. The type of blood sample used for the blood gas analysis was not documented in the available medical record. Reference intervals are representative adult values, not verified institution-specific intervals. Confirm against the original laboratory reports. The blood-gas sample type was not documented.

BUN, blood urea nitrogen; WBC, white blood cell count.

On Day 2, piperacillin/tazobactam was prescribed, and antimicrobial therapy was subsequently initiated according to the clinical progress notes. Laboratory evaluation on Day 3 showed persistent elevation of cardiac biomarkers, with a troponin level of 62.9 ng/L, creatine kinase level of 666 U/L, and CK-MB level of 28 U/L. The metabolic profile was notable for a total calcium level of 5.1 mg/dL, phosphorus level of 9.8 mg/dL, and albumin level of 1.99 g/dL. The calculated calcium-phosphorus product was approximately 50 mg^2/dL^2 . Total protein was 5.12 g/dL (Table 2).

Laboratory Panel	Laboratory Test	Patient Value	Unit	Reference Range
Mineral metabolism	Calcium, total	5.1	mg/dL	8.5–10.5 mg/dL (total calcium; laboratory-dependent)
	Phosphorus	9.8	mg/dL	2.5–4.5 mg/dL
Protein status	Albumin	1.99	g/dL	3.5–5.0 g/dL
	Total protein	5.12	g/dL	6.0–8.3 g/dL
Cardiac biomarkers	Troponin	62.9	ng/L	Assay-specific; verify institutional 99th-percentile upper reference limit
	Creatine kinase	666	U/L	Approx. 30–200 U/L; laboratory-dependent
	Creatine kinase-MB	28	U/L	Assay-specific; verify institutional reference interval

TABLE 2: Selected Laboratory Findings on Day 3

Laboratory findings obtained on Day 3, including mineral metabolism, serum protein, and cardiac biomarker parameters. Reference intervals are representative adult values, not verified institution-specific intervals. Total calcium should be interpreted in the context of marked hypoalbuminemia and kidney disease.

CK, creatine kinase; CK-MB, creatine kinase-MB.

During hospitalization, the patient underwent multidisciplinary evaluation by the departments of general surgery, urology, vascular surgery, and nephrology because of progressive tissue necrosis and clinical concern for infection. On Day 7, because of persistent leukocytosis and lack of clinical improvement, antimicrobial therapy was escalated to meropenem. A sputum culture obtained on Day 6 grew extended-spectrum β-lactamase (ESBL)-producing *Klebsiella pneumoniae* (Table 3).

Specimen	Finding	Result
Sputum	Organism	<i>Klebsiella pneumoniae</i>
	Resistance phenotype	Extended-spectrum β-lactamase (ESBL) producer

TABLE 3: Sputum Culture on Day 6

Microbiological findings from a sputum specimen obtained on Day 6.

ESBL, extended-spectrum β-lactamase.

On Day 7, laboratory evaluation showed a hemoglobin level of 8.8 g/dL, leukocyte count of $23.67 \times 10^3/\mu\text{L}$, and platelet count of $590 \times 10^3/\mu\text{L}$ (Table 4). Given the progression of tissue necrosis and persistent clinical concern for infection, surgical management was undertaken.

Laboratory Test	Patient Value	Unit	Reference Range
Hemoglobin	8.8	g/dL	13.5–17.5 g/dL (adult male)
Hematocrit	25	%	41–53% (adult male)
White blood cell count	23.67	×10 ³ /μL	4.0–11.0 ×10 ³ /μL
Absolute neutrophils	19.41	×10 ³ /μL	1.5–7.5 ×10 ³ /μL
Platelets	590	×10 ³ /μL	150–400 ×10 ³ /μL

TABLE 4: Selected Complete Blood Count Findings on Day 7

Hematologic findings obtained on Day 7, highlighting persistent leukocytosis, neutrophilia, anemia, and thrombocytosis. Reference intervals are representative adult values, not verified institution-specific intervals.

A urine culture obtained on Day 8 subsequently grew ESBL-producing Escherichia coli, with 80,000 CFU/mL (Table 5). These findings documented concomitant respiratory and urinary microbiological processes in the setting of severe systemic illness; however, no cultures from the necrotic genital or lower-extremity tissue were available.

Urine	Organism	Escherichia coli		No growth/no clinically significant growth
	Quantity	80000	CFU/mL	Interpret in clinical context; significance depends on symptoms and collection method
	Resistance phenotype	Extended-spectrum β-lactamase (ESBL) producer		Not applicable; microbiological resistance phenotype

TABLE 5: Urine Culture on Day 8

Microbiological findings from a urine specimen obtained on Day 8. The urine culture result does not establish infection of the necrotic genital or lower-extremity tissues. Colony-count interpretation depends on symptoms and specimen collection method.

CFU, colony-forming units; ESBL, extended-spectrum β-lactamase.

Surgical management

Right Above-Knee Amputation

On Day 8, a right above-knee amputation was performed under regional anesthesia with the patient in the supine position. The amputation level was selected according to the extent of tissue necrosis and the viability of the remaining soft tissues. A circumferential incision was made, followed by dissection through the subcutaneous tissue, fascia, and muscle. The neurovascular structures were identified and controlled. The major nerves were sharply transected under gentle traction and allowed to retract proximally. The femur was exposed and transected at the predetermined level, and the bone edges were smoothed. Hemostasis was achieved, the wound was irrigated, and the viability of the remaining soft tissues was assessed. Primary layered closure was subsequently performed.

Total Penectomy With Perineal Urethrostomy

During the same operative session, total penectomy with perineal urethrostomy was performed. Following preparation and sterile draping of the perineogenital field, the extent of viable tissue was assessed, and a circumferential incision was made at the penile base. The penile shaft, urethra, and corpora cavernosa were exposed. The superficial and deep dorsal vessels were identified and controlled; minimal bleeding was observed from these structures. The urethra was mobilized from the corpora cavernosa while preserving adequate length for reconstruction. The corpora cavernosa and corpus spongiosum were divided, and the necrotic penile tissue was resected. Hemostasis was confirmed, and the operative field was inspected for gross residual necrotic tissue. The remaining viable urethral segment was mobilized toward the perineum without tension or torsion. The urethral end was spatulated and secured to the perineal skin with interrupted sutures, creating a wide, tension-free perineal urethrostomy (Figure 2). Patency and urinary drainage were confirmed. The operative field was irrigated, a Penrose drain was placed, and the perineal

tissues were closed in layers (Figure 3). A Foley catheter was inserted through the urethrostomy, and sterile dressings were applied.



FIGURE 2: Perineal Urethrostomy Following Total Penectomy

Intraoperative view demonstrating the completed perineal urethrostomy following total penectomy.



FIGURE 3: Primary Closure of the Perineoscrotal Surgical Site

Intraoperative view demonstrating primary layered closure following resection of necrotic tissue.

Postoperative course

Following surgery, the patient remained under multidisciplinary surveillance and continued kidney replacement therapy with peritoneal dialysis. On postoperative Day 2, laboratory evaluation showed a leukocyte count of $33.89 \times 10^3/\mu\text{L}$, hemoglobin of 7.9 g/dL, and platelet count of $578 \times 10^3/\mu\text{L}$ (Table 6).

Laboratory Panel	Laboratory Test	Patient Value	Unit
Complete blood count	Hemoglobin	7.90	g/dL
	White blood cell count	33.89	×10 ³ /μL
	Platelets	578	×10 ³ /μL
Blood chemistry	Glucose	187	mg/dL
	Urea	165	mg/dL
	Blood urea nitrogen	77.10	mg/dL
	Serum creatinine	9.2	mg/dL
Serum electrolytes	Sodium	125	mmol/L
	Chloride	83	mmol/L
Inflammatory marker	C-reactive protein	186.90	mg/L

TABLE 6: Selected Laboratory Findings on Postoperative Day 2
Laboratory findings obtained on postoperative Day 2, highlighting persistent leukocytosis, anemia, renal dysfunction, electrolyte abnormalities, and systemic inflammation.
BUN, blood urea nitrogen; CRP, C-reactive protein.

The patient developed worsening anemia requiring packed red blood cell transfusion. Hyperglycemia was also documented, with a glucose level of 728 mg/dL. A blood gas analysis was obtained to further evaluate the metabolic disturbance; however, the type of blood sample was not documented in the available medical record.

Antimicrobial therapy with meropenem and vancomycin was subsequently adjusted according to the available microbiological and clinical information. Despite removal of the grossly necrotic tissue, ischemic changes persisted postoperatively. The right above-knee amputation stump subsequently developed marginal necrosis and wound dehiscence.

During a subsequent postoperative assessment, the patient remained in poor general condition. Blood pressure was 76/57 mmHg, heart rate 60 beats/min, respiratory rate 16 breaths/min, temperature 36°C, and oxygen saturation 94% with supplemental oxygen. He was responsive but poorly cooperative, with generalized pallor and dehydrated mucous membranes. Chest expansion was preserved bilaterally, without crackles or wheezing. The abdomen was flat and soft, without signs of peritoneal irritation, and a Tenckhoff catheter was present. The perineal urethrostomy showed no bleeding or dehiscence. In the right lower extremity, following the above-knee amputation, marginal stump necrosis and surgical wound dehiscence were observed, with persistent ischemic changes.

Given the systemic deterioration, persistent tissue ischemia, and the absence of a further surgical intervention expected to provide meaningful clinical benefit, conservative management and close clinical monitoring were continued.

On the following day, the patient experienced sudden clinical deterioration. He was found unconscious, with mottled skin and absent distal pulses. Cardiopulmonary resuscitation was initiated for approximately 10 minutes without return of spontaneous circulation. Electrocardiography demonstrated an isoelectric tracing in all leads, and death was pronounced at 08:53. According to the death certificate, the causes of death were acute respiratory failure and septic shock, with peripheral arterial disease, end-stage kidney disease, hypertension, and cardiac arrhythmia listed as secondary diagnoses.

Discussion

Calciphylaxis, also known as calcific uremic arteriolopathy, is a rare and potentially fatal complication of advanced chronic kidney disease. Its pathophysiology involves vascular calcification, endothelial dysfunction, thrombosis, and progressive impairment of tissue perfusion, which may ultimately result in ischemia and tissue necrosis [1,2].

The present case involved multiple clinical features associated with calciphylaxis, including end-stage

kidney disease requiring kidney replacement therapy, longstanding diabetes mellitus, severe hypoalbuminemia, and abnormalities in mineral metabolism. Serum phosphorus was 9.8 mg/dL and total calcium was 5.1 mg/dL, corresponding to a calculated calcium-phosphorus product of approximately 50 mg²/dL². However, these abnormalities are not specific for calciphylaxis. No intact parathyroid hormone measurement was available, and neither histopathological confirmation nor radiological evidence of vascular calcification was documented.

The serum albumin level of 1.99 g/dL was another clinically relevant finding. Hypoalbuminemia is a recognized risk factor for calciphylaxis and may reflect the combined effects of malnutrition, systemic inflammation, and advanced chronic disease [1-3]. The patient had no documented history of warfarin exposure. Although warfarin is a recognized risk factor, its absence does not exclude calciphylaxis in a patient with multiple other potential risk factors [1-3].

Penile involvement is uncommon and has been described predominantly in patients with end-stage kidney disease and diabetes mellitus. In the series reported by Karpman et al., which included 34 patients with penile calciphylaxis, all patients had end-stage kidney disease and 76% had diabetes mellitus; approximately two-thirds also had gangrene at extragenital sites. Mortality in that series was 64%, with a mean time to death of 2.5 months [4]. These findings illustrate the severity of penile necrosis in patients with advanced kidney disease but do not establish calciphylaxis as the cause of penile necrosis in every affected patient.

An important diagnostic consideration in the present case was the coexistence of severe peripheral arterial disease. The patient had established necrosis involving the right toes, left heel, penis, and left hemiscrotum, in addition to longstanding diabetes mellitus. This distribution is compatible with extensive ischemic tissue injury and raises the possibility of critical limb ischemia and diabetic vasculopathy as major contributors to the clinical presentation. Penile necrosis in patients with end-stage kidney disease should therefore not be attributed automatically to calciphylaxis, as severe peripheral arterial disease, diabetic vasculopathy, infection, and calcific uremic arteriolopathy may produce overlapping clinical findings or coexist [5]. In the present case, the absence of documented vascular studies, such as Doppler ultrasonography, ankle-brachial index, toe pressures, computed tomography angiography, or angiography, limited further characterization of the vascular contribution to the tissue necrosis. Accordingly, the necrosis was considered multifactorial, with severe peripheral arterial disease and diabetic vasculopathy representing important contributors and suspected uremic calciphylaxis remaining an additional diagnostic consideration.

The absence of histopathological confirmation represents another important diagnostic limitation. There is no single diagnostic test for calciphylaxis, and diagnosis relies on the integration of clinical findings, risk factors, laboratory abnormalities, and complementary investigations [1,2]. Histopathological examination may support the diagnosis in selected cases; however, biopsy of penile lesions may be associated with additional tissue injury and impaired wound healing and therefore remains controversial [2,7]. In this patient, no histopathological examination was available, and no radiological report documenting vascular calcification was identified. Therefore, definitive attribution of the necrosis to calciphylaxis was not possible. The clinical suspicion was based on the combination of end-stage kidney disease, kidney replacement therapy, diabetes mellitus, profound hypoalbuminemia, hyperphosphatemia, calcium abnormalities, and extensive multisite tissue necrosis. The diagnosis was consequently considered suspected uremic calciphylaxis rather than confirmed calciphylaxis.

Infection was also considered during the clinical course because of progressive leukocytosis, extensive tissue necrosis, and systemic deterioration. An ESBL-producing *Klebsiella pneumoniae* was isolated from a sputum specimen, whereas an ESBL-producing *Escherichia coli* was isolated from a urine specimen. However, these microbiological findings documented respiratory and urinary isolates, respectively, and did not establish infection of the necrotic penile, scrotal, or lower-extremity tissues. No blood, wound, tissue, or intraoperative cultures from the necrotic sites were available. Therefore, although infection may have contributed to the patient's systemic deterioration, the available microbiological data did not permit confirmation of infection involving the necrotic tissues.

The management of suspected calciphylaxis is complex and generally requires multidisciplinary care. Current approaches may include optimization of dialysis and mineral metabolism, nutritional support, wound care, analgesia, treatment of documented or suspected infection, and selected surgical intervention [1,2,8]. Sodium thiosulfate is frequently used off-label because of its proposed calcium-chelating and antioxidant effects; however, evidence supporting its efficacy remains limited, and data in patients receiving peritoneal dialysis are particularly heterogeneous [9]. Sodium thiosulfate was not documented as part of this patient's treatment. Similarly, no documented intervention specifically directed at hyperparathyroidism was available, and no intact parathyroid hormone measurement was documented. Given the extensive established necrosis and severe peripheral vascular disease, management focused on surgical removal of nonviable tissue and treatment of the patient's systemic complications.

The role of surgery in penile necrosis associated with suspected calciphylaxis remains individualized. Reported approaches range from conservative wound management to debridement, partial or total penectomy, and, in selected cases, revascularization procedures [4,5,10]. Surgical intervention may be

considered when there is extensive nonviable tissue, progressive local destruction, clinically suspected infection, or other indications for removal of irreversibly damaged tissue. However, surgery does not correct the underlying vascular disease and may not prevent progression of ischemic injury when perfusion remains severely compromised.

In the present case, extensive genital and lower-extremity necrosis led to a right above-knee amputation and total penectomy with perineal urethrostomy during the same operative session. Although the grossly necrotic tissue was removed, ischemic changes persisted postoperatively, and the amputation stump subsequently developed marginal necrosis and wound dehiscence. This course illustrates the difficulty of achieving durable wound healing in patients with advanced kidney disease, diabetes mellitus, and severe peripheral arterial disease. The persistence of ischemic changes after surgery also supports the importance of considering the underlying vascular status when evaluating extensive necrosis in this population.

The patient died on Day 28, approximately 20 days after surgery. According to the death certificate, the causes of death were acute respiratory failure and septic shock, with peripheral arterial disease, end-stage kidney disease, hypertension, and cardiac arrhythmia listed as secondary diagnoses. The clinical course demonstrates the severe systemic consequences that may accompany extensive tissue necrosis in patients with advanced kidney disease. Although the outcome occurred in the setting of suspected calciphylaxis, the available evidence does not allow the fatal outcome to be attributed specifically to calciphylaxis.

Limitations

The principal limitation of this report is the absence of histopathological confirmation and documented radiological evidence of vascular calcification. No intact parathyroid hormone measurement was available. In addition, vascular assessment with Doppler ultrasonography, ankle-brachial index, toe pressures, computed tomography angiography, or angiography was not documented, limiting characterization of the contribution of severe peripheral arterial disease to the tissue necrosis. Serial alkaline phosphatase measurements were also unavailable.

Microbiological evaluation was limited because no blood cultures or cultures from the penile, scrotal, lower-extremity, or intraoperative necrotic tissues were available. The documented sputum and urine cultures therefore could not establish infection of the necrotic tissues. Histopathological examination of the resected tissue was also not available.

These limitations preclude a definitive diagnosis of calciphylaxis and prevent determination of the relative contribution of calciphylaxis, severe peripheral arterial disease, diabetic vasculopathy, and infection to the patient's tissue necrosis. Nevertheless, the combination of end-stage kidney disease, kidney replacement therapy, diabetes mellitus, profound hypoalbuminemia, mineral abnormalities, and extensive multisite necrosis made suspected uremic calciphylaxis an important diagnostic consideration, while severe peripheral arterial disease and diabetic vasculopathy remained major potential contributors to the clinical presentation.

Conclusions

Penile necrosis in patients with end-stage kidney disease is an uncommon and potentially devastating finding that warrants prompt multidisciplinary evaluation. In this patient, the coexistence of end-stage kidney disease requiring peritoneal dialysis, diabetes mellitus, severe peripheral arterial disease, profound hypoalbuminemia, mineral metabolism abnormalities, and multisite tissue necrosis raised substantial clinical suspicion for uremic calciphylaxis. However, the absence of histopathological and radiological confirmation precluded a definitive diagnosis, and the tissue necrosis was considered multifactorial.

Progressive genital and lower-extremity necrosis required surgical management with right above-knee amputation and total penectomy with perineal urethrostomy. Despite removal of the grossly necrotic tissue, ischemic changes persisted, followed by stump wound complications and subsequent clinical deterioration, with septic shock and acute respiratory failure documented as causes of death. This case highlights the importance of considering suspected uremic calciphylaxis in the differential diagnosis of genital and peripheral necrosis in patients with advanced kidney disease while recognizing the potential contribution of severe peripheral arterial disease, diabetic vasculopathy, and infection. Early multidisciplinary assessment and individualized management based on tissue viability, infection, vascular status, and overall clinical condition are essential.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

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Disclosures

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