Case Report

A sentinel case of penile calciphylaxis in end-stage renal disease: Focus on mortality predictors

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ABSTRACT

Penile calciphylaxis is a rare yet devastating vascular complication of end-stage renal disease (ESRD) on chronic dialysis, marked by arterial calcification, ischemic necrosis, and a mortality rate exceeding 60%. We report a male in his early forties with ESRD on hemodialysis who presented with dry gangrene of the glans penis. Imaging revealed extensive vascular calcification from the iliac to penile arteries, with markedly elevated calcium–phosphate product, hypoalbuminemia, and secondary hyperparathyroidism. Partial penectomy was performed, but the patient succumbed to systemic complications within 3 weeks. This case underscores the grave prognosis associated with penile calciphylaxis, particularly when accompanied by hypoalbuminemia, elevated calcium–phosphate product, and diffuse vascular involvement. Prompt recognition of such predictors, aggressive metabolic correction, and patient education are crucial to improving survival in this otherwise fatal condition.

Key words: Debridement, End-stage renal disease, Penile calciphylaxis, Risk prevention, Vascular calcification

Penile calciphylaxis, or calcific uremic arteriolopathy of the penis, is an exceedingly rare and often fatal manifestation of systemic vascular calcification in patients with ESRD undergoing dialysis. The reported incidence among hemodialysis-dependent individuals ranges from 1% to 4.1% [1], with fewer than 50 cases described in the literature to date. The condition is characterized by progressive calcification and fibrosis of small- and medium-sized arterial vessels within the penile vasculature, leading to ischemia, necrosis, and in many cases, gangrene. While calciphylaxis more commonly affects adipose-rich regions such as the abdomen, thighs, and buttocks, penile involvement is particularly ominous, indicating advanced systemic disease [2].

Given these grim outcomes and the lack of consensus on optimal management, we present a case of penile calciphylaxis in a middle-aged male with diabetes and ESRD. This report underscores the urgent need for early identification of risk factors, preventive strategies, and comprehensive patient education to mitigate mortality associated with this rare condition.

CASE PRESENTATION

Informed consent was obtained from the patient before the commencement of this study. A man in his early 40s with a history of type 2 diabetes mellitus (12 years), ESRD (2 years), and recently diagnosed hypertension presented with severe penile pain and blackish discoloration of the glans lasting 1 month. He had been receiving maintenance hemodialysis 3 times a week. No history of trauma, surgical procedures, or systemic symptoms was reported.

General examination revealed pallor, mild pedal edema, and poor nutritional status, consistent with chronic renal disease. Local examination showed dry gangrene of the glans penis with a well-demarcated necrotic margin and palpable vascular calcification, obliterated external urethral meatus, and palpable calcification of bilateral corpora cavernosa (Fig. 1).

Laboratory analysis showed: white cell counts 8,530 cells/mm^3; elevated serum calcium; and phosphate levels of 12.1 and 6.3 mg/dL, respectively, resulting in a high calcium-phosphate product of 76.2; elevated intact parathyroid hormone levels of 138 pg/mL with reduced Vitamin D and albumin levels of 20 ng/mL and 2.9 g/dL, respectively.

Radiographs demonstrated extensive calcification extending from the common iliac to the penile arteries (Fig. 2). Penile Doppler further confirmed severely compromised flow in the dorsal and cavernosal arteries.

The patient underwent partial penectomy for the removal of the necrotic glans. Swab cultures revealed Morganella morganii, although tissue cultures

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Figure 1: Demarcated necrosis of the glans penis

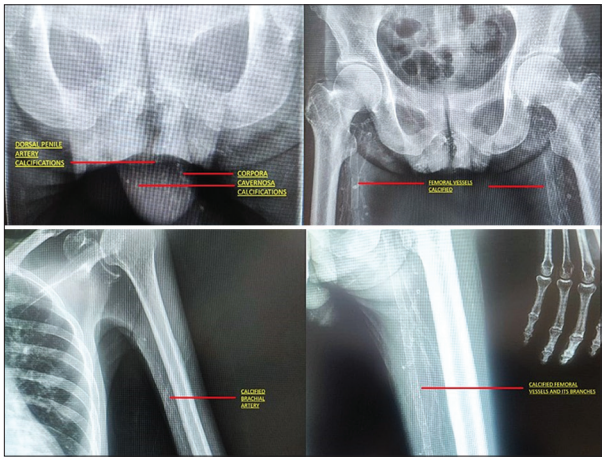

Figure 2: Radiographs demonstrating calcification along major pelvic and penile arteries

remained sterile. Histopathology confirmed necrosis with vascular calcification, establishing a diagnosis of penile calciphylaxis. Pain management included opioid analgesia. Broad-spectrum intravenous antibiotics were administered empirically. After 5 days, the patient was discharged with a tunneled catheter for ongoing dialysis.

One-week follow-up revealed satisfactory wound healing. However, an attempt to establish a radiocephalic arteriovenous fistula failed due to diffuse vascular calcification. The patient ultimately succumbed to systemic complications 21 days post-diagnosis.

DISCUSSION

Penile calciphylaxis is an exceptionally rare but catastrophic vascular disorder signifying advanced systemic calcific arteriolopathy, most often observed in patients with ESRD receiving dialysis. Although calciphylaxis typically affects adipose-rich regions such as the thighs or abdomen, penile involvement remains particularly ominous, reflecting extensive vascular compromise. The penis, with its rich collateral circulation derived from the internal pudendal artery, is generally protected from ischemic insult; hence, necrosis at this site indicates diffuse vascular calcification and near-complete luminal occlusion, portending a dismal prognosis.

The underlying pathophysiology involves medial calcification, intimal proliferation, and thrombosis of small- to medium-sized arteries, culminating in progressive ischemia and tissue necrosis. In ESRD, deranged calcium–phosphate metabolism, secondary hyperparathyroidism, and chronic inflammation accelerate this process [3,4]. Prognostic determinants include hypoalbuminemia (<3.0 g/dL), elevated calcium–phosphate product (>70), widespread vascular involvement, poorly controlled diabetes, prolonged dialysis, and the need for extensive surgery such as penectomy [4].

A new comparative review of published literature underscores the uniformly poor outcomes of penile calciphylaxis. Karpman *et al*. reported a 64% mortality rate in their analysis of 34 cases, identifying low albumin and extragenital involvement as key predictors of death [5]. García Morua *et al*. described five patients with ESRD, among whom mortality approached 80% despite aggressive therapy [6]. Similarly, Yang *et al*. documented a 60.7% 3-month mortality in cases with extragenital spread [7]. In a more recent report, Chagam *et al*. presented a patient with severe vascular insufficiency and diffuse calcification who succumbed despite multimodal therapy [8]. Another case by Barreira *et al*. emphasized the role of secondary hyperparathyroidism and demonstrated transient improvement following parathyroidectomy, although survival remained limited [9]. A 2023 review by Raza *et al*. highlighted the consistent association between hypoalbuminemia, systemic vascular calcification, and poor wound healing in penile calciphylaxis [10].

Therapeutic approaches remain largely palliative. Conservative measures, including sodium thiosulfate infusion, cinacalcet for refractory hyperparathyroidism, meticulous wound care, and nutritional optimization, are often attempted with limited success [3,6,10]. Surgical intervention – whether debridement or penectomy – may provide pain relief and local control but rarely alters mortality outcomes. The case presented herein reinforces the convergence of multiple adverse predictors, diabetes, elevated calcium–phosphate product, hypoalbuminemia, and diffuse vascular calcification, culminating in rapid clinical decline despite prompt diagnosis and intervention.

Given the grim prognosis, preventive strategies assume paramount importance. Early recognition of risk factors, maintenance of serum albumin above 3.5 g/dL, strict metabolic control, and timely management of secondary hyperparathyroidism may modestly improve outcomes. Patient education regarding early symptoms such as penile pain or discoloration remains a vital component of care.

CONCLUSION

Penile calciphylaxis remains a rare but fatal complication of ESRD. Given the lack of curative interventions

and poor prognosis, the emphasis must shift toward prevention. Early risk identification, optimization of metabolic parameters, and patient counseling can play a key role in improving outcomes. Future research and multicentric data are needed to guide evidence-based management of this severe condition.

AUTHOR CONTRIBUTION STATEMENT

All authors will have reviewed, discussed, and agreed to their individual contributions before manuscript submission.

- Dr. Gautam Shubhankar: Research conception and design: yes. Data acquisition: yes. Statistical analysis: yes, Data analysis and interpretation: yes. Drafting of the manuscript: yes. Critical revision of the manuscript: yes. Obtaining funding, no. Administrative, technical, or material support: yes. Supervision: yes, yes. Approval of the final manuscript: yes.
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  Research conception and design: yes. Data acquisition: yes. Statistical analysis: yes, Data analysis and interpretation: yes. Drafting of the manuscript: yes. Critical revision of the manuscript: yes. Obtaining funding, no. Administrative, technical, or material support: yes. Supervision: yes, yes. Approval of the final manuscript: yes.
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ETHICS STATEMENT

Informed and written consent had been taken from all the patients before the study. The manuscript has been prepared in strict observation of the research and publication ethics guidelines. All studies including human subjects or human data have been reviewed and approved. Principles embodied in the Declaration of Helsinki (2013) for all investigations involving human materials have been followed.

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