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CASE REPORT PEER REVIEWED | OPEN ACCESS

Utilization of Faxitron™ imaging for the pathologic diagnosis of calciphylaxis: A case report

Muhammad Awais, Laura R Vick, Amy E Flischel, Youssef Al Hmada, Robert T Brodell

ABSTRACT

Introduction: Calciphylaxis is a rare, life-threatening condition characterized by vascular calcification, thrombosis, and ischemic necrosis of the skin and subcutaneous tissues. Diagnosing calciphylaxis can be challenging due to non-specific clinical features and limitations of conventional biopsy techniques.

Case Report: We describe a 62-year-old female with a history of hypertension, type 2 diabetes mellitus, and sarcoidosis, presenting with painful necrotic abdominal lesions. Initial punch biopsy revealed non-specific changes without evidence of calciphylaxis. During surgical debridement, calcified vessels were observed intraoperatively. Faxitron™ imaging of excised tissue confirmed vascular calcifications, guiding targeted histopathological analysis. Subsequent examination demonstrated medial calcification, intimal hyperplasia, and vascular occlusion, confirming calciphylaxis.

Conclusion: This case highlights the utility of Faxitron™ imaging in enhancing the diagnostic accuracy of calciphylaxis. By guiding targeted histological evaluation, this imaging modality can minimize false negatives and facilitate early, accurate diagnosis, improving patient outcomes.

Muhammad Awais[1], Laura R Vick[2], Amy E Flischel[3], Youssef Al Hmada[1], Robert T Brodell[1,3]

Affiliations: [1]Department of Pathology, University of Mississippi Medical Center, Jackson, Mississippi, USA; [2]Department of Surgery, University of Mississippi Medical Center, Jackson, Mississippi, USA; [3]Department of Dermatology, University of Mississippi Medical Center, Jackson, Mississippi, USA.

Corresponding Author: Muhammad Awais, University of Mississippi Medical Center, Jackson, Mississippi, USA; Email: mawais@umc.edu

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INTRODUCTION

Calciphylaxis is a rare, life-threatening condition characterized by vascular calcification, thrombosis, and ischemic necrosis of the skin and subcutaneous tissues [1]. It primarily affects patients with chronic kidney disease (CKD) but can also occur in those with diabetes, hyperparathyroidism, or other metabolic disorders [2]. The pathophysiology of calciphylaxis involves vascular smooth muscle cell dysfunction, endothelial injury, and chronic inflammation, which contribute to medial calcification, intimal hyperplasia, and subsequent luminal occlusion [3]. These changes result in ischemia and tissue necrosis, leading to painful, non-healing skin ulcers with high morbidity and mortality [4].

While X-rays can show a net-like evidence of calcification, pathologic examination of tissue remains the gold standard for the diagnosis of calciphylaxis. It is well known that a small punch biopsy specimen can miss the calcified vessels of calciphylaxis [5, 6]. Larger incisional biopsies can be bread-loafed and lead to a greater likelihood that calciphylaxis will be seen within the tissue.

Faxitron™ imaging, a high-resolution digital radiographic system, has been widely used in breast cancer diagnostics to detect microcalcifications in mammography specimens to ensure tissue most likely to show tumor is prepared for sectioning [7]. Given that vascular calcifications are a hallmark of calciphylaxis, we hypothesized that Faxitron™ imaging could enhance diagnostic accuracy by identifying calcified vessels in tissue specimens before histopathological processing. This approach may facilitate targeted sectioning, reducing sampling errors and improving diagnostic yield.

In this case report, we describe a patient with suspected calciphylaxis in whom Faxitron™ imaging played a crucial role in confirming the diagnosis. A large debulking specimen was submitted and the Faxitron™ guided sectioning led to a prompt diagnosis without recuts or further biopsies. We discuss the advantages of this imaging modality over random tissue sampling and its potential integration into routine pathological evaluation.

CASE REPORT

We present a 62-year-old female with a history of chronic kidney disease (CKD) stage 3B, hypertension, type 2 diabetes mellitus, pulmonary sarcoidosis, morbid obesity [body mass index (BMI) 44.26 kg/m²)], and peripheral arterial disease (PAD). She had a prior history of acute kidney injury (AKI) requiring intermittent hemodialysis but was not on chronic dialysis at the time of presentation.

The patient presented with painful necrotic lesions involving the abdominal wall and left thigh. Physical examination revealed discolored necrotic lesions with dark, indurated tissue (Figure 1), which were intensely painful and resistant to conventional analgesics. Initial punch biopsy of the affected skin revealed morphea-like changes but no histopathological evidence of calciphylaxis or leukocytoclastic vasculitis. Given the progression of necrosis and concern for superimposed infection, the patient underwent surgical debridement of the necrotic areas.

During sharp excisional debridement, stiff, calcified vessels were observed within the subcutaneous tissue of the abdominal wall and left thigh (Figure 2). During the procedure, all necrotic and infected tissue, including skin and subcutaneous fat, was excised.

Excised tissue was evaluated using Faxitron™ high-resolution radiographic imaging, which revealed extensive vascular calcifications, particularly within the subcutaneous arterioles (Figure 3). These findings prompted targeted histopathologic analysis, which demonstrated medial calcification, intimal hyperplasia, and luminal occlusion, confirming the diagnosis of calciphylaxis (Figure 4). Notably, these diagnostic features were not present in the initial punch biopsy, highlighting the limitation of conventional biopsy techniques and the added value of Faxitron™ imaging in guiding targeted tissue examination.

Following the diagnosis, the patient was initiated on sodium thiosulfate therapy, along with intensified wound care and pain management. Given her multiple comorbidities, including PAD and CKD, a multidisciplinary approach was employed, involving nephrology, dermatology, wound care, and vascular surgery. Despite initial clinical improvement, she experienced wound healing challenges, requiring ongoing debridement and negative pressure wound therapy. The patient's condition remained guarded, but early Faxitron™-guided diagnosis facilitated a more targeted therapeutic strategy, emphasizing the potential utility of

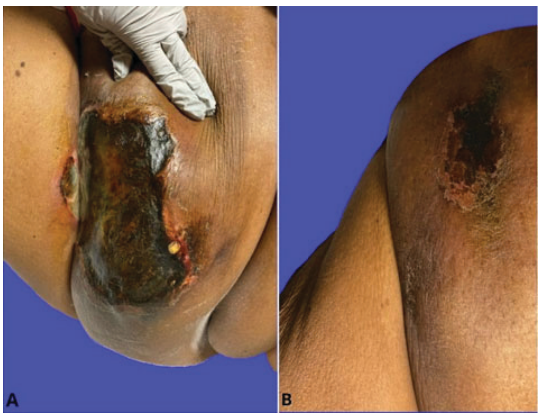

Figure 1: Tissue obtained during surgical debridement of necrotic lesions. (A) Left abdominal wall lesion showing dark, discolored necrotic tissue. (B) Right abdominal wall lesion exhibiting similar necrosis and discoloration.

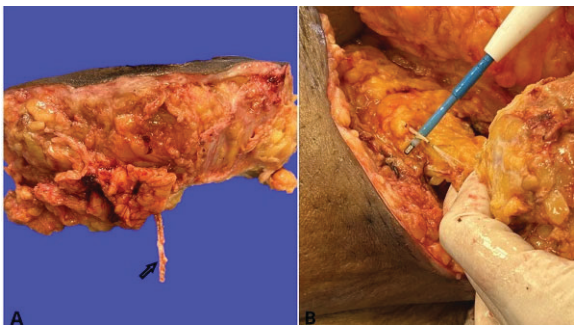

Figure 2: Intraoperative identification of calcified vessels within the subcutaneous tissue. Stiff, calcified vessels are visible in the affected tissue (arrow).

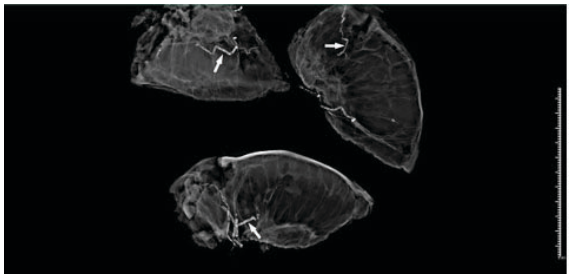

Figure 3: Faxitron™ digital radiographic image of excised tissue. The image demonstrates prominent calcifications within the vessels (arrows), guiding targeted histopathological analysis.

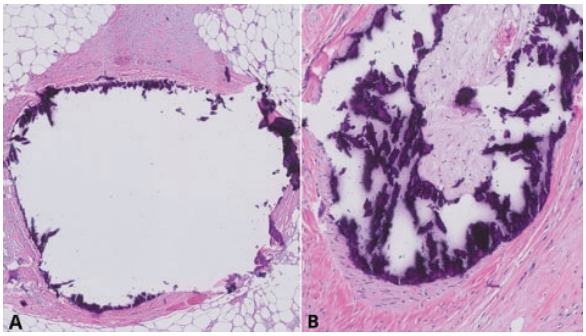

Figure 4: Histopathological examination of tissue from debridement. (A) Scanning view of tissue showing vascular calcium deposits in the subcutaneous tissue (H&E, 50×). (B) High-power view revealing medial calcification, intimal hyperplasia, and complete vascular occlusion, consistent with calciphylaxis (H&E, 100×).

this imaging modality in improving diagnostic accuracy and guiding treatment in calciphylaxis.

DISCUSSION

Calciphylaxis poses significant diagnostic challenges due to its varied and non-specific clinical features and the limitations of conventional biopsy techniques [3]. In this case, the initial biopsy failed to identify the underlying vascular calcification, likely due to sampling error—a known pitfall in diagnosing calciphylaxis [3]. The integration of Faxitron™ imaging into the diagnostic workflow and targeted tissue sampling during specimen grossing allowed for precise identification of calcified vessels, guiding the selection of appropriate sections for histological analysis.

Given the heterogeneous distribution of calciphylaxis lesions, traditional histopathologic examination may result in false-negative results due to sampling error. Faxitron™ imaging enhances the detection of microcalcifications that may be overlooked during conventional gross examination, improving the selection of sections for microscopic evaluation and increasing diagnostic accuracy. This helps minimize the likelihood of false-negative results and facilitates earlier diagnosis of calciphylaxis. A study involving over 1000 patients with calciphylaxis found that 55% were diagnosed through skin biopsy, while the remaining 45% were diagnosed clinically [8]. The potential for nondiagnostic biopsy results, which may require repeat procedures, as well as the associated risks and complications, are key factors in why biopsies are not universally pursued [9].

This case highlights the importance of recognizing unusual patterns of calcification within the body. While distinct from calciphylaxis, a previous report described massive heterotopic ossification on the spleen's surface [10], underscoring the importance of considering atypical locations for ectopic bone formation. This case, along with our previous findings, emphasizes the need for a high index of suspicion for abnormal calcification in various anatomical sites.

Despite its potential advantages, Faxitron™ imaging has limitations. This is a single case report, and the findings may not be generalizable to a larger population. Additionally, the study lacks a control group, making it difficult to assess the true diagnostic yield of Faxitron™ imaging. Future studies are required to evaluate the effectiveness of the Faxitron™ to increase the yield of positive diagnosis in patients determined to have calciphylaxis on the first attempt, thus reducing false-negative results.

The use of Faxitron™ imaging could improve patient outcomes by enabling earlier and more accurate diagnosis of calciphylaxis. Earlier detection allows for timely intervention, which may help prevent disease progression and reduce morbidity. Additionally, incorporating Faxitron™ imaging into pathology workflows may prove cost-effective by reducing the need for repeat biopsies and recuts by improving diagnostic accuracy, ultimately leading to more targeted treatment strategies. Faxitron™ can be billed by the pathologist using Current Procedural Terminology (CPT®) code: 76098. The Medicare allowable fee ranges from $41 to $45 [11]. The number of sections taken from tissue to identify calcified vessels can certainly be reduced by this technique, and the need for recuts is reduced, saving time and money.

CONCLUSION

This case underscores the critical role of targeted examination of calcified vessels utilizing an advanced imaging technique (Faxitron™) in the evaluation of calciphylaxis. Targeted pathological assessment minimizes the risk of false negative biopsy results. The integration of this imaging modality into routine pathology workflows, combined with multidisciplinary collaboration, can improve diagnostic precision and ultimately enhance patient outcomes.

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Author Contributions

Muhammad Awais – Conception of the work, Analysis of data, Drafting the work, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Laura R Vick – Conception of the work, Acquisition of data, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Amy E Flischel – Conception of the work, Acquisition of data, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Youssef Al Hmada – Conception of the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Robert T Brodell – Conception of the work, Design of the work, Acquisition of data, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Guarantor of Submission

The corresponding author is the guarantor of submission.

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Consent Statement

Written informed consent was obtained from the patient for publication of this article.

Conflict of Interest

Robert T Brodell is a principal investigator for clinical trials (Novartis, Sanofi, and Lilly), participates in the Corevitas Psoriasis Biologic Registry, receives royalties from UpToDate, has received consulting fees from Amgen, and holds stock ownership in Veradermics, Inc. Muhammad Awais, Laura R Vick, Amy E Flischel, and Youssef Al Hmada have no conflicts of interest.

Data Availability

All relevant data are within the paper and its Supporting Information files.

ABOUT THE AUTHORS

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Muhammad Awais is a pathology resident at the University of Mississippi with a keen interest in dermatopathology. With overseas training in plastic surgery, he thoroughly enjoys studying and diagnosing skin diseases.

Robert T Brodell, MD is Tenured Professor and Chair, Department of Pathology; Professor and Past Founding Chair, Department of Dermatology; and Billy S. Guyton, MD Distinguished Professor at the University of Mississippi Medical Center.