An Unusual FDG-PET/CT Documentation in Aleukemic Leukemia Cutis: Atypical Penile, Scrotal, and Leg Muscles Involvement

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Abstract

Aleukemic leukemia cutis (ALC) is a rare condition with a relatively poor prognosis, clinically presenting as skin and subcutaneous nodules commonly involving head and neck region with discrete atypical leukemic cells infiltrating in the skin on histopathology. The lesions on the genital area skin are seldom reported. A 49-year-old male presented with joint pains and multiple subcutaneous nodules clinically with biopsy proving it as leukemia cutis. Bone marrow aspiration and biopsy were suggestive of normocellular myeloid preponderant bone marrow with mild increase in eosinophils. The ^{18}F-fluorodeoxyglucose positron emission tomography/computed tomography (^{18}F-FDG PET/CT) revealed metabolically active FDG avid ill-defined soft tissue attenuation involving the entire length of penile shaft with central necrotic area, diffuse scrota skin thickening, and lateral compartment muscles of left leg, in addition to multiple hypermetabolic metastatic lymph nodes, and diffuse hypermetabolic marrow in humerii and femora. Despite prompt investigations and initiation of management, the patient succumbed in 15 days post-FDG PET/CT. The present report depicts an atypical case of ALC, with FDG PET-CT showing extensive and unusual sites of disease involvement, emphasizing its potential role in ALC.

Keywords

- aleukemic leukemia cutis
- ^{18}F-FDG PET/CT
- penile and scrotal involvement
- cutaneous manifestation
- cancer imaging

Introduction

Aleukemic leukemia cutis (ALC) presents as discrete atypical leukemic cells infiltrate the skin in the absence of circulating blasts or bone marrow findings consistent with leukemia. This entity is associated with a poor prognosis and usually precedes clinically detectable leukemia by weeks to months.[1] LC could present as the first sign of a new diagnosis of leukemia. The role of ^{18}F-fluorodeoxyglucose (^{18}F-FDG) positron-emission tomography/computed tomography (PET/CT) in the diagnosis, staging, tumor biology evaluation, and therapy response assessment in several hematological malignancies is well documented, and the evaluation of disease burden is an important decision-making marker that impacts the patient management and disease prognosis significantly.

Case Study

A 49-year-old male presented with multiple subcutaneous nodules and joint pains. The attending clinicians came to an

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initial tentative diagnosis of gout, with suspicion of rheumatoid arthritis as there was associated right knee and ankle joint swelling. The blood counts and chemistry including liver function tests were found to be within normal limits. Elevated lactate dehydrogenase and uric acid levels were noted. On further workup, the CT scan of the chest, abdomen, and pelvis revealed multiple nodules in abdomen, chest wall, upper thigh, and right testis with associated bilateral pleural effusion. Subcutaneous nodule biopsy revealed LC with dense mixed dermal intracellular infiltration that involved vascular capillaries and adnexal structures. Bone marrow aspiration revealed normocellular myeloid preponderant bone marrow with mild increase in eosinophils, M/E ratio 635:1; the erythroid series revealed reduced cellularity (12%); megakaryocytic series revealed adequate cellularity; myeloid series (%) revealed promyelocytes (0), myelocytes (07), metamyelocytes (02), polymorphs (69), eosinophils (07), basophils (0), monocytes (0), promonocytes (0); and lymphoid series (%) revealed adequate mature lymphocytes. The bone marrow biopsy report revealed hypocellular marrow, predominantly cartilage scanty marrow spaces showing trilineage hematopoiesis. The myeloid series was normal with mild increase in eosinophils, adequate megakaryocytes, and erythroid series was mildly reduced with normal maturation. A whole-body ^{18}F-FDG PET/CT (►**Figs. 1**, **2**) undertaken 60 minutes after intravenous injection of 6.7 mCi of ^{18}F-FDG, using a whole-body full-ring dedicated three-dimensional PET-CT scanner (Gemini TF; 250 mAs, 120 kVp, noncontrast CT scan), revealed multiple hypermetabolic soft tissue attenuation nodules in region of right shoulder (maximum standardized uptake value [SUV_{max}]: 17.5), right lateral chest wall, right forearm anterior aspect, left arm and forearm, anterior abdominal wall at the level of pelvic inlet, bilateral root of penis, largest in left inguinal region measuring 3.3×2.3 cm (SUV_{max}: 18.2), left gluteal, left popliteal fossa, bilateral ankle involvement. Hypermetabolic ill-defined soft tissue attenuation involving the entire length of penile shaft with central necrotic area (SUV_{max}: 19.2) was associated with hypermetabolic diffuse skin thickening (►**Fig. 3**). Linear and avid uptake was noted in lateral compartment muscles of left leg (SUV_{max}: 18) (►**Fig. 2**), with hypermetabolic left level V, right axillary, right popliteal, bilateral inguinal nodes (number of nodes right > left with SUV_{max}: 17.5), and diffuse hypermetabolic marrow in

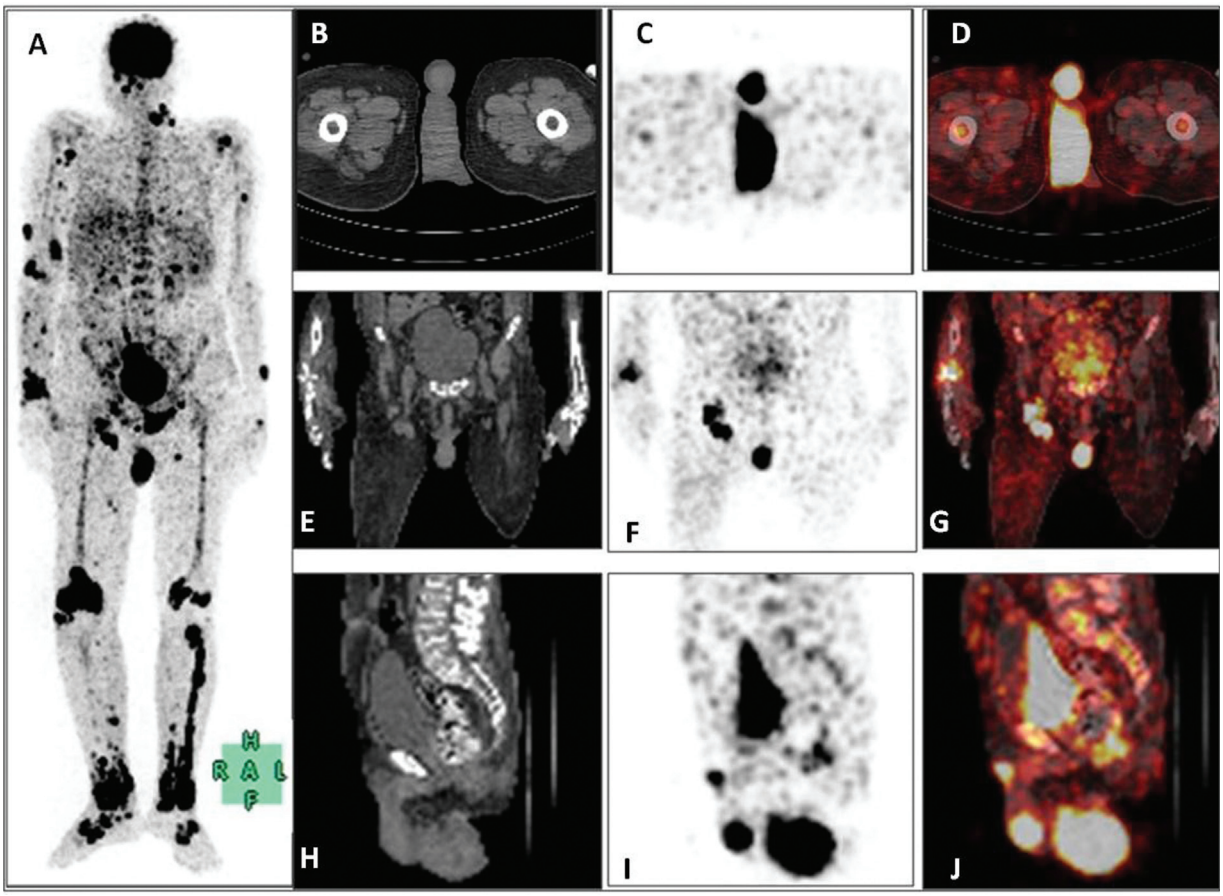

Fig. 1 (**A**) Maximum intensity projection (MIP) positron emission tomography (PET) image; (**B–D**) computed tomography (CT), PET, and fused PET/CT axial images showing metabolically active ill-defined soft tissue attenuation involving the entire length of penile shaft with central necrotic area (maximum standardized uptake value [SUV_{max}]: 19.2); (**E–G**) CT, positron emission tomography (PET), and fused PET/CT coronal images showing metabolically active nodules in right forearm anterior aspect, right inguinal nodes, penile bulb; (**H–J**) CT, PET, and fused PET/CT sagittal images showing metabolically active soft tissue attenuation nodules in root of penis (SUV_{max}: 18.2), penile bulb, diffuse skin thickening of scrotum. Hypermetabolic diffuse involvement of bone marrow of both femora, with associated intense uptake in marrow of right femur in distal epiphysis (SUV_{max}: 22.5) (MIP image A).

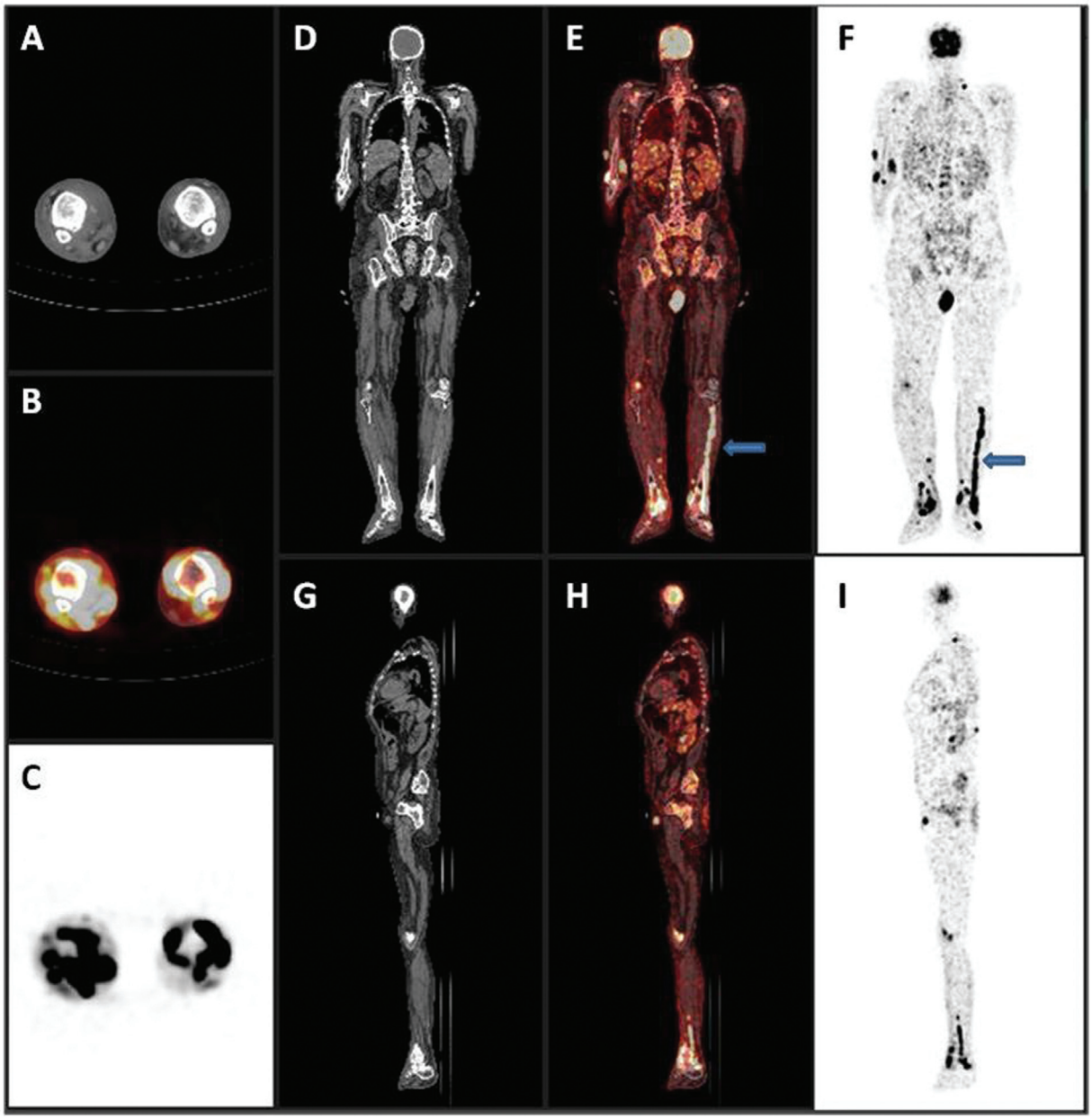

Fig. 2 (**A–C**) Computed tomography (CT), positron emission tomography (PET), and fused PET/CT axial images showing metabolically active subcutaneous regions in both ankles; (**D–F**) CT, PET, and fused PET/CT coronal images showing linear hypermetabolism uptake noted in left leg-lateral compartment muscles (*arrow*), maximum standardized uptake value (SUV_{max}): 18; (**G–I**) CT, PET, and fused PET/CT sagittal images showing metabolically active left inguinal subcutaneous nodule—largest right measuring 3.3 × 2.3 cm, SUV_{max}: 17.5.

humerii and femora with significant epiphyseal and metaphyseal marrow involvement of distal right femur (SUV_{max}: 22.5) (►**Fig. 1**). Ametabolic right pleural effusion, pericardial effusion, ascites, and diffuse subcutaneous edema were noted. Liver and spleen revealed no definitive focal FDG uptake and no lung nodule was noted in the whole-body survey. Despite prompt investigations and medical management, the patient succumbed in 15 days post-FDG PET/CT.

Discussion

The present case thus portrays a patient of ALC, with extensive subcutaneous leukemic deposits, atypical penile, and scrotal involvement documented on ^{18}F-FDG PET/CT and a rapidly fatal disease course. LC is an important yet understudied extramedullary manifestation of leukemia,[2] characterized by clinically visible skin lesions (nodules or erythematous papules) caused by skin infiltration of neoplastic leukocytes.[3] Most of the patients are male and the most common associated malignancy has been acute myeloid leukemia.[3] The present case was also a male, a rapidly progressive course developing skin nodules more in torso including penile and scrotal involvement, and succumbed in less than a month postdiagnosis indicating the importance of high suspicion and diagnosis for initiating the appropriate line of management early in the disease course.

More commonly, ALC is noted in the setting of a previously diagnosed hematological malignancy, but rarely it may be

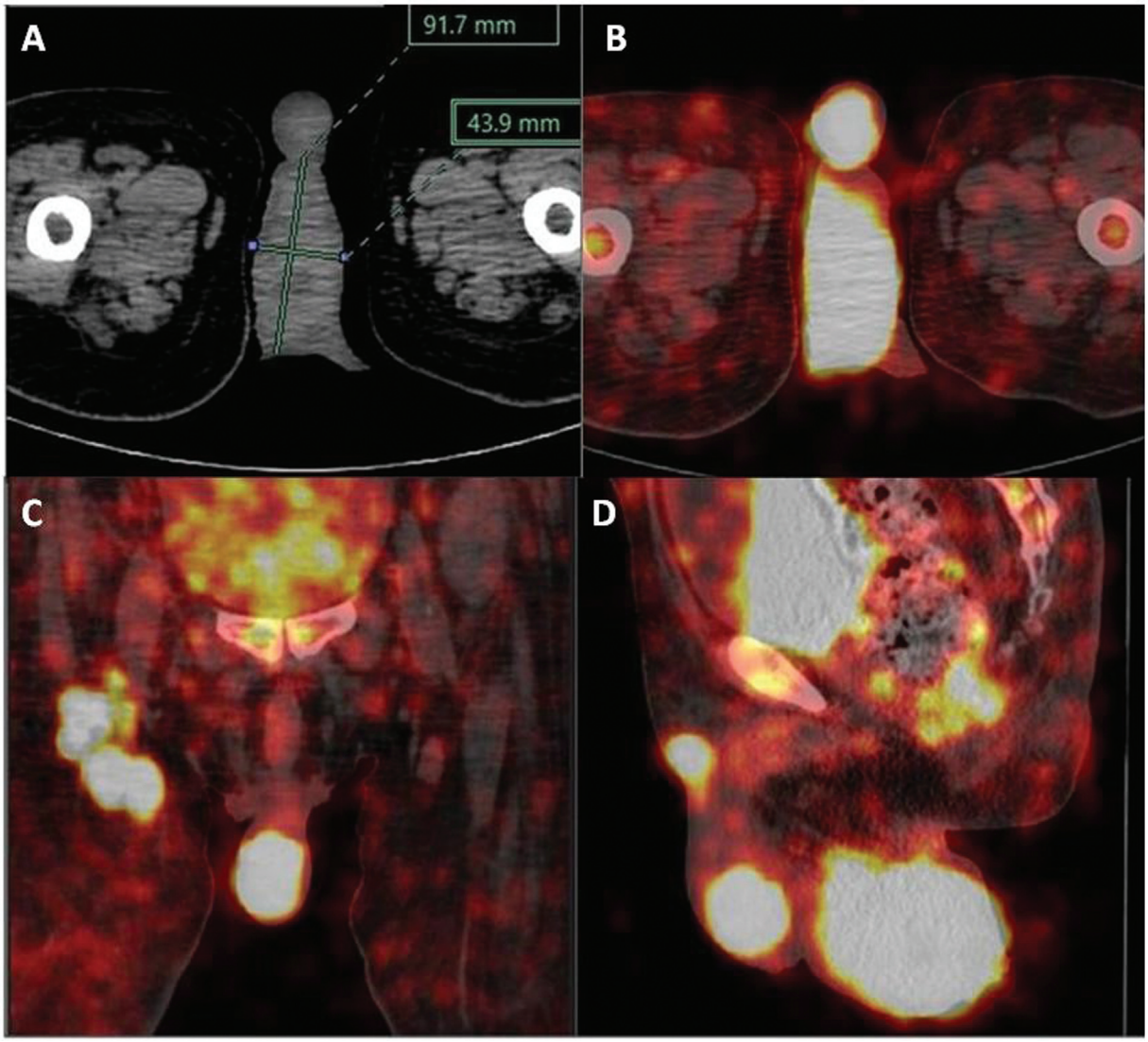

Fig. 3 Anon-contrast computed tomography (CT) axial image showing ill-defined soft tissue attenuation in penile shaft with central necrotic area; (**B**) fused positron emission tomography/computed tomography (PET/CT) axial image showing metabolic activity involving the entire length of penis (maximum standardized uptake value [SUV_{max}]: 19.2); (**C**) fused PET/CT coronal images showing metabolically active right inguinal nodes and penile bulb; (**D**) fused PET/CT sagittal images showing metabolically active soft tissue attenuation nodules in root of penis-largest in left inguinal region measuring 3.3 × 2.3 cm (SUV_{max}: 18.2), penile bulb, and diffuse skin thickening of scrotum.

the first sign of leukemia.[4,5] In our patient, there was no history of prior hematologic disorder and LC preceded blood or bone marrow manifestations of leukemia. Zheng et al in their report observed that FDG-PET/CT revealed widespread cutaneous and subcutaneous hypermetabolic lesions in many parts of the body, and heterogeneously increased uptakes in the bone marrow. Later, the bone marrow biopsy and second skin biopsy were performed. Pathological examination from both specimens demonstrated acute monocytic leukemia.[6] In our patient, skin biopsy already had proven LC. Bone marrow biopsy had revealed hypocellularity, while further FDG-PET/CT revealed multiple subcutaneous hypermetabolic nodules, atypical penile shaft, and scrotal with leg muscle involvement.

LC lesions are seldom seen on the genital organs. One case of a well-differentiated myeloid sarcoma in the penile foreskin in an apparently healthy 29-year-old male presenting with phimosis and simultaneous priapism where a cutaneous myeloid sarcoma was reported in the penile foreskin first time.[7] LC typically presents on the face and neck as well as exposed areas. Ng at al published a 78-year-old gentleman with known chronic lymphocytic leukemia (CLL) and asymptomatic raised lesion in his inner prepuce. The lesion immunohistology was consistent with cutaneous manifestation of CLL, highlighting the importance of taking LC into consideration in patients with known CLL with unusual features.[8] Plaza et al in their paper on cutaneous manifestations reported that they are an uncommon presentation of subclinical B cell CLL, highlighting the importance of maintaining a high index of suspicion for a lymphoproliferative process in cases with unusual or atypical clinicopathologic features.[9]

The role of FDG PET/CT in cancer imaging is reported in literature in evaluating primary and staging of penile cancer, penile metastasis from malignancies like renal cell

carcinoma, and malignancies of urogenital system (urothelial bladder, prostate) or the rectosigmoid and colon. LC is often associated with additional locations of extramedullary involvement and can forecast a poor prognosis.[5,10] Given its diverse and nonspecific clinical presentation, LC diagnosis relies exclusively on immunohistochemistry,[11] which identifies myeloid cells of LC, with CD68 and CD43, as first-line stains.[1] FDG-PET/CT can be an important whole-body modality evaluating the disease extent, precisely informing sites of involvement and guiding treatment, with its potential role in posttreatment response assessment.

Conclusion

In summary, in our patient, LC was the first manifestation of leukemia and predated hematological manifestation. In the described patient, FDG-PET/CT revealed extensive uptake in the subcutaneous leukemic deposits, atypical penile and scrotal leukemic involvement, and leg muscles, highlighting the role of metabolic imaging in this condition.

Conflict of Interest
None.

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