

Tomotherapy for Extensive Re-Irradiation of Locally Recurrent Cutaneous T-Cell Lymphoma in a Frail Elderly Patient - a Case Report

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ABSTRACT

CD30+ cutaneous T-cell lymphomas are rare lymphoid proliferations. These are characterized by radiosensitivity and can present as localized or recurrent lesions. Although rarely reported, re-irradiation is an interesting therapeutic option in cases of recurrence and localized cutaneous relapse. Modern irradiation techniques, such as tomotherapy, make this more feasible.

We report the case of an 84-year-old patient with multiple comorbidities and an incidental mediastinal adenosquamous carcinoma. He was followed for recurrent CD30+ cutaneous T-cell lymphoma of the right lower limb. The patient first received 3D conformal radiotherapy (30 Gy in 10 fractions) to the primary lesion. After recurrence, he underwent tomotherapy (30 Gy/10 fractions) to the recurrent lesion. Following further progression, a third re-irradiation (30 Gy/15 fractions) was delivered to the entire lower limb cutaneous tissue. This case shows that modern radiotherapy techniques, including tomotherapy, are safe and effective for locally recurrent cutaneous lymphomas and provide excellent local control.

KEYWORDS: *clinical tolerance, cutaneous T-cell lymphoma (CTCL), multiple primary cancers, Radiotherapy, reirradiation, Tomotherapy*

1. Introduction

Cutaneous T-cell lymphomas (CTCL) represent a heterogeneous group of non-Hodgkin malignant lymphoid proliferations. They are characterized by a predominantly cutaneous tropism. Although they account for less than 5% of all non-Hodgkin lymphomas (1,2), they require a tailored approach to management. This is due to their specific clinical and evolutionary features.

Among CTCLs, CD30-positive forms, including both primary cutaneous anaplastic large cell lymphomas and lymphomatoid papulosis, are

characterized by an often indolent course and excellent sensitivity and response to radiotherapy (3,4).

Clinically, patients with CTCL present with progressive skin lesions ranging from patches to tumors, typically evolving from macules. The indolent form of the disease may be present months before clinical presentation (5).

Radiotherapy thus plays a central role in the treatment of these lymphomas, whether with curative or palliative intent. It achieves high rates of complete response, even at low doses (5–7). However, local or multifocal recurrences remain frequent, sometimes necessitating re-irradiation. In such cases, tissue tolerance, particularly in elderly patients or those with

multiple comorbidities, becomes a major concern (8–12).

The emergence of modern radiotherapy techniques, such as intensity-modulated radiotherapy (IMRT) and tomotherapy, has significantly improved treatment precision. These advances now allow re-irradiation of extensive volumes while preserving healthy tissue as much as possible (8,9,13–16).

Here, we report the case of an elderly patient with a recurrent CD30-positive cutaneous T-cell lymphoma who underwent re-irradiation of the right lower limb with tomotherapy, achieving excellent clinical and dosimetric tolerance. This case illustrates the safety and feasibility of a modern, advanced technical approach in the context of extensive cutaneous recurrence.

2. Clinical Case

We report the case of an 84-year-old male patient managed for recurrent cutaneous T-cell lymphoma (CTCL) localized to the right lower limb. His medical history included arterial hypertension, dyslipidemia, type 2 diabetes, and a chronic smoking history of 92 pack-years, having quit 22 years ago. Surgically, he

had undergone an aorto-bi-iliac prosthesis, bilateral saphenous vein stripping, and angioplasty with stenting of the right external iliac artery.

The patient’s clinical history began in early 2023 with the appearance of a small millimetric cutaneous lesion on the right lower limb, with slow progression. Approximately one year after the gradual increase in size and onset of pruritus, the patient consulted a dermatologist in February 2024.

Dermatologic examination revealed a single cutaneous lesion measuring 2 cm in its largest diameter, pruritic, infiltrated, and ulcerated, located at the center of the middle anterior third of the right leg. Examination of the lymph node areas was unremarkable, and no other cutaneous lesions were identified. A skin biopsy was performed on the same day.

Histopathological analysis confirmed the diagnosis of CD30-positive, ALK-negative T-cell lymphoma with a clonal T-cell receptor (TCR) gamma rearrangement.

Two weeks after histological confirmation, on February 26, 2024, an initial 18F-FDG PET scan showed hypermetabolism strictly limited to the cutaneous lesion, without nodal or visceral involvement, classifying the disease as localized.

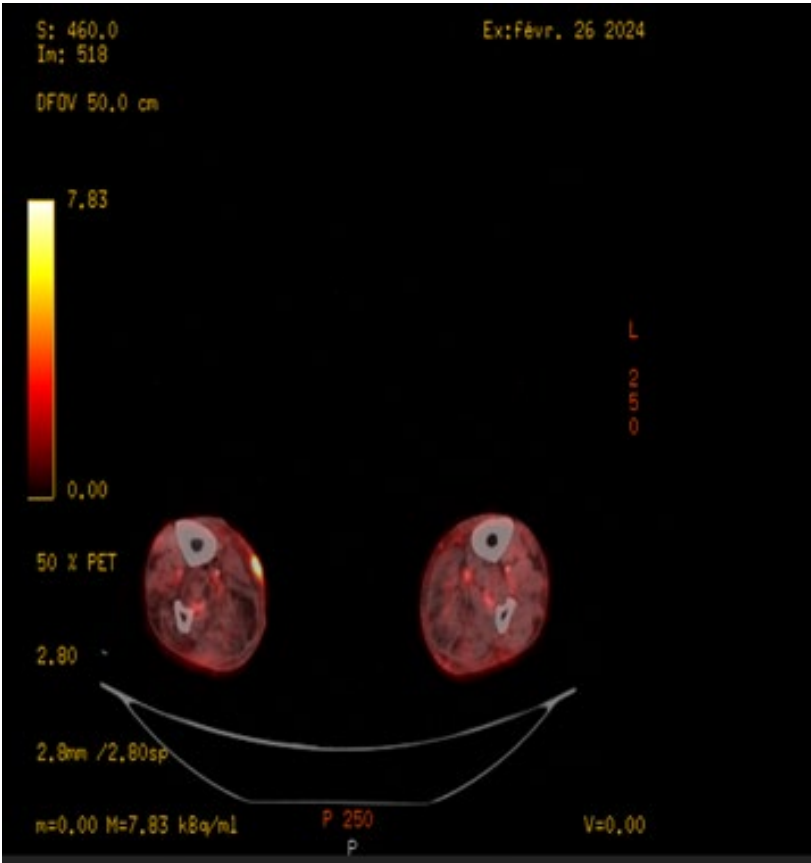


Figure 1: 18 FDG PET scan showing hyperfixation of the initial lesion (February 2024).

2.1. First Irradiation

A dosimetric CT simulation was performed on April 24, 2024, with 2.5-mm slices, without contrast, from the knee to the foot. Three-dimensional conformal radiotherapy (3D-CRT) was delivered using a TrueBeam 6 MV linear accelerator at a total dose of 30 Gy in 10 fractions of 3 Gy, five sessions per week, from April 29 to May 13, 2024, with two temporary interruptions due to machine maintenance. CTV 1 included macroscopic tumor volume (GTV 1) plus a 2 cm anatomoclinical margin. PTV 1 consisted of CTV + 5 mm isotropic margin

Planning utilized two anterior-posterior beams to ensure homogeneous coverage. Dosimetric analysis followed ICRU recommendations, with a maximum dose of 31.97 Gy and D95% of 29.03 Gy. Patient positioning was verified daily via portal imaging.

Clinical tolerance was excellent, with no radiodermatitis or acute toxicity (CTCAE v4). Three months after radiotherapy, the lesion had completely resolved, and the patient remained in complete cutaneous response for approximately 9 months.



Figure 2. Simulation setup for the initial radiotherapy of the first lesion on the right leg.

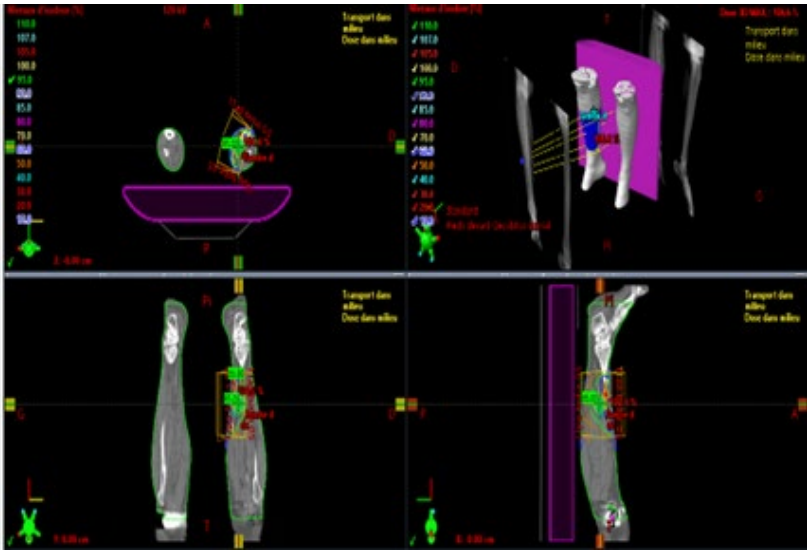


Figure 3. Dosimetric plan of the first radiotherapy on the initial lesion of the right leg.

2.2. Cutaneous Recurrence and Discovery of Lung Cancer

At the end of January 2025, the patient presented with a cutaneous recurrence consisting of a 2.5 cm ulcerated nodule in the right popliteal fossa, associated with multiple smaller nodules on the leg up to mid-thigh. Popliteal and inguinal lymph nodes were unaffected.

A PET scan on February 12, 2025, revealed intense hypermetabolism of the cutaneous lesions and hypermetabolic left hilar and subcarinal lymph nodes. Endobronchial ultrasound (EBUS) with biopsy confirmed a mediastinal nodal adenosquamous lung carcinoma harboring a KRAS G12C mutation, staged as cTx N2 M0 (stage IIIA). Clinically, the patient had general deterioration, weight loss, anorexia, and reduced autonomy (PS 2).

A comprehensive pre-therapeutic workup was performed, including laboratory analyses, vaccinations, echocardiography, thoraco-abdomino-pelvic and brain CT scans, and functional respiratory evaluation.

2.3. Second Irradiation (Popliteal Nodule)

On February 21, 2025, a multidisciplinary meeting recommended irradiation of the popliteal nodule. Tomotherapy was delivered from February 26 to March 11, 2025, at 30 Gy in 10 fractions of 3 Gy. CTV 2 was created by delineating the popliteal nodule and adding 2 cm anatomoclinical margin. PTV 2 consisted of CTV 2 to which we added a 5 mm isotropic margin.

Clinical regression of the nodule was achieved, although new cutaneous lesions appeared on the leg and thigh.



Figure 4. Simulation setup for the second irradiation at the right popliteal lesion.

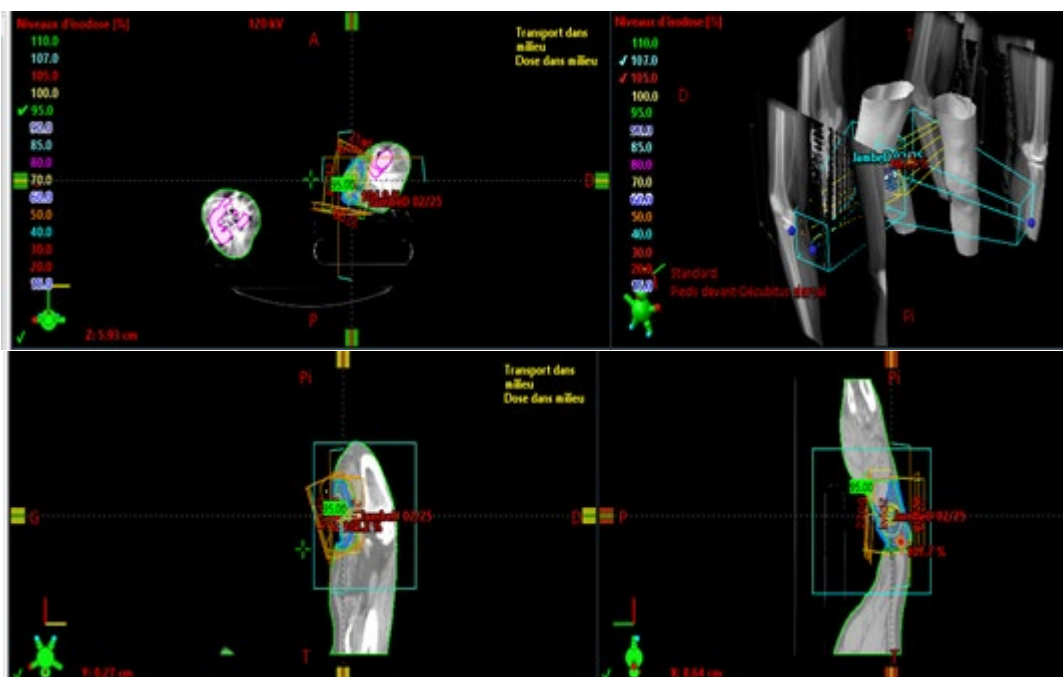


Figure 5. Dosimetric plan of radiotherapy delivered to the second right popliteal lesion.

2.4. Mediastinal Radiotherapy

For lung cancer, a 4D simulation was performed on May 16, 2025, to account for respiratory motion. Mediastinal radiotherapy targeting affected lymph nodes was delivered from May 26 to July 11, 2025, at 66 Gy in 33 fractions of 2 Gy, delivered 5 times per week. No aggressive chemotherapy was administered due to the low chemosensitivity of adenosquamous carcinoma, advanced age, and multiple comorbidities.

2.5. Extended Re-Irradiation of the Right Lower Limb

Due to cutaneous progression, extended re-irradiation of the right lower limb was performed. CT simulation was performed on June 27, 2025, with 2.5-mm slices from the pelvis to the feet. Tomotherapy IGRT 6 MV delivered 30 Gy in 15 fractions of 2 Gy, five sessions per week, from July 15 to August 2, 2025. CTV 3 covered the skin of the right lower limb, including all at-risk areas A 5 mm was used from CTV to PTV.

Fields were planned to fully cover the limb. Planning was optimized to spare normal tissues (skin, bone, muscle, vessels). Quality control included portal and absolute dosimetry, and daily positioning was verified via MV-CT. Dosimetric analysis showed a maximum dose of 33.76 Gy and a D95% of 29.04 Gy.

The re-irradiation achieved a good clinical response and excellent cutaneous tolerance, with no radiodermatitis or lymphedema. One month after treatment, dermatological examination showed significant regression of the lesions.

2.6. Outcome and Follow-up

Two months after thoracic radiotherapy, thoraco-abdomino-pelvic and brain CT scans showed pulmonary and cerebral metastatic progression, leading to exclusive supportive care. The patient subsequently developed confusion and swallowing difficulties and died at the end of September 2025 due to lung cancer.



Figure 6. Simulation for total re-irradiation of the right lower limb.

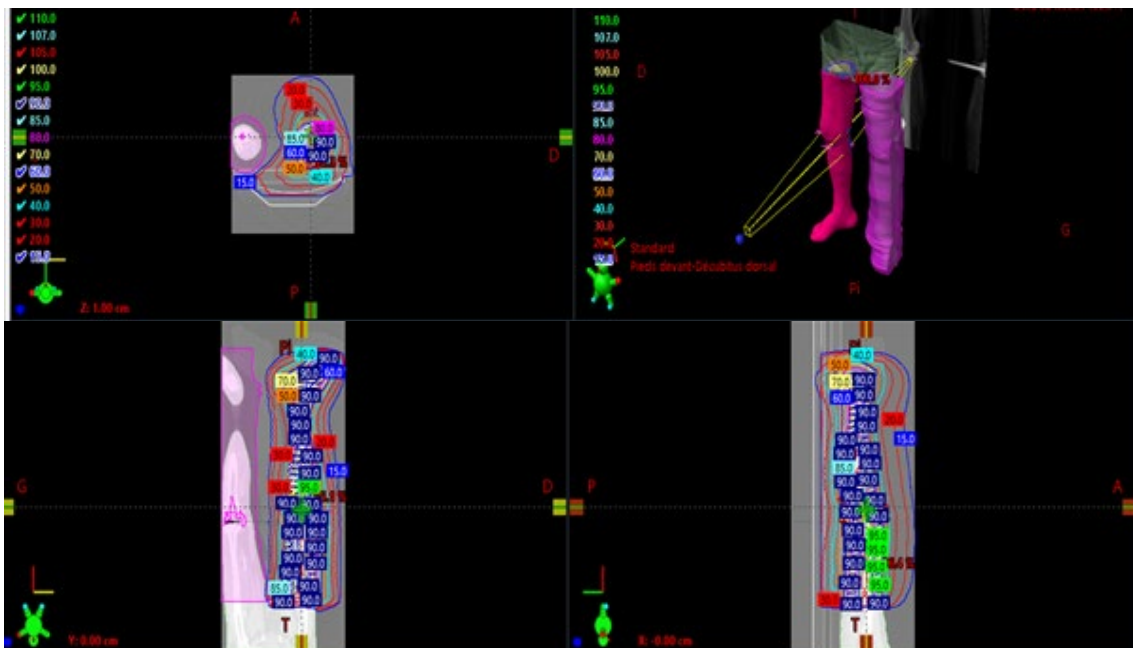


Figure 7. Dosimetric plan for the re-irradiation of the entire right lower limb.

Table 1: Overview of radiotherapy treatments delivered to the patient.

1st Ir-radiation	29 April – 13 May 2024	Initial lesion, right leg	3D-CRT (True-Beam 6 MV)	30 Gy	10 × 3 Gy	CTV 1: 2 cm anatomoclinical margin around tumor (GTV 1) PTV 1: CTV + 5 mm isotropic	Excellent, no radi-odermatitis or acute toxicity
2nd Ir-radiation	26 February – 11 March 2025	Right popliteal nodule	Tomo-therapy	30 Gy	10 × 3 Gy	CTV 2: popliteal nodule (GTV 2) + 2 cm anatomoclinical margin PTV 2: CTV + 5 mm isotropic	Good, no acute toxicity
Medi-astinal Radio-therapy	26 May – 11 July 2025	Medias-tinal lymph nodes (lung cancer)	4D Tomo-therapy	66 Gy	33 × 2 Gy	CTV: lymph nodes + margins according to respiratory motion PTV : CTV + 5 mm	Moderate, no se-vere events re-ported
Ex-extended Re-Ir-radiation	15 July – 2 August 2025	Right lower limb (skin)	Tomo-therapy IGRT (MV-CT)	30 Gy	15 × 2 Gy	CTV 3: entire skin of right lower limb, in-cluding all at-risk ar-eas PTV: CTV + 5 mm iso-tropic	Excellent, good clinical response and cutaneous tol-erance; planning optimized to re-spect previous cu-mulative doses

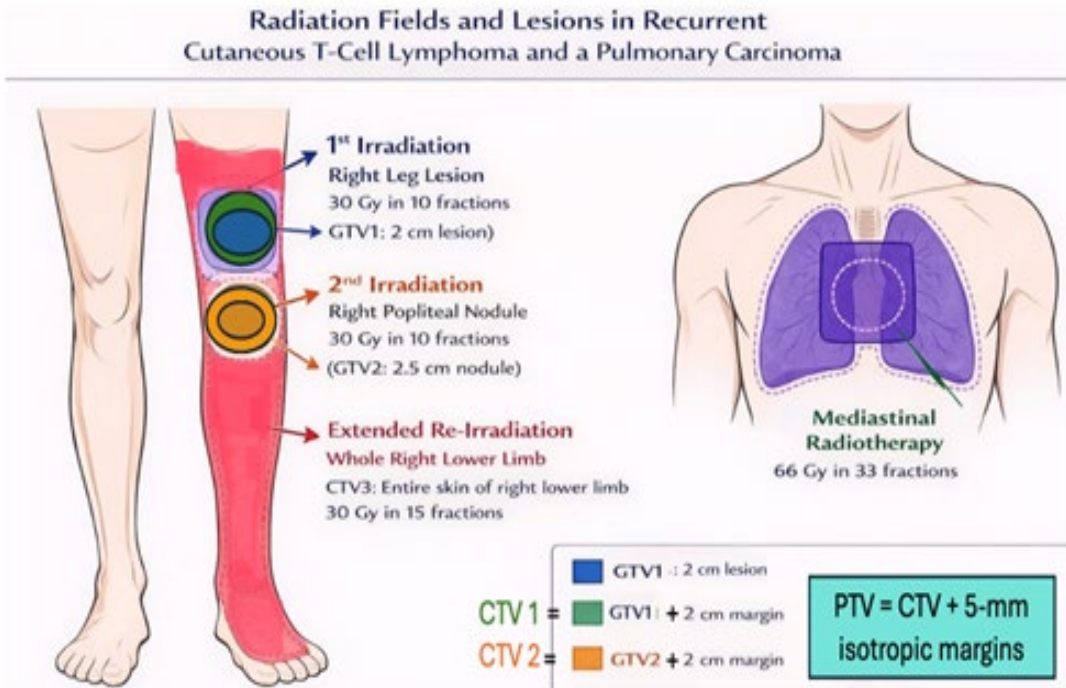


Figure 8. Anatomical diagrams approximately illustrate the main therapeutic target volumes used for treatment

Chronology of Radiation Therapies for the Patient

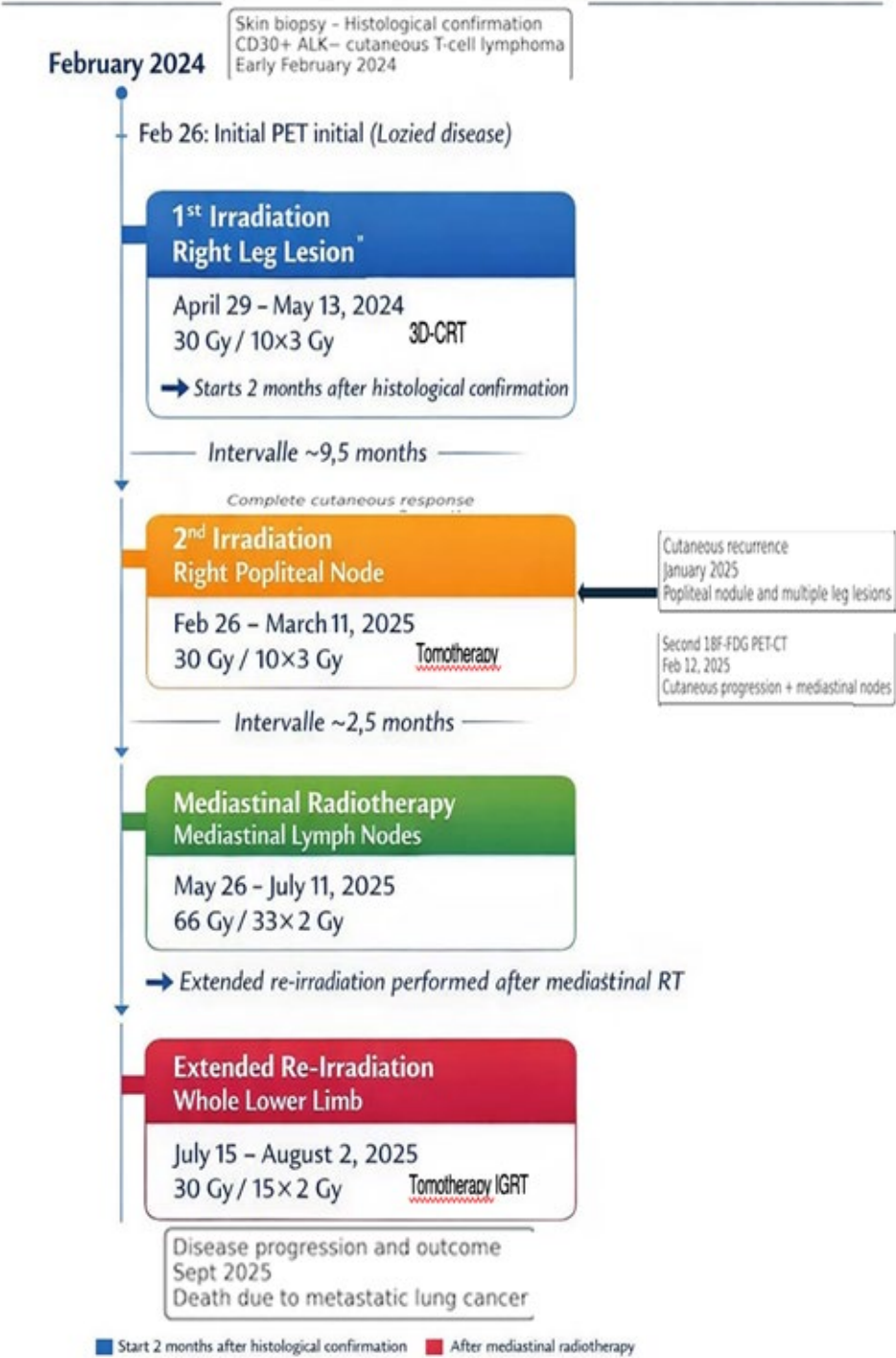


Figure 9. Illustration of the timeline of radiotherapy sequences performed for our patient.

3. Discussion

Cutaneous T-cell lymphomas represent a rare and varied group of malignant lymphoid proliferations with cutaneous tropism, accounting for less than 5% of all non-Hodgkin lymphomas (1,2). Among them,

CD30+ forms are characterized by often localized progression, a potential for recurrence, and notable sensitivity to radiotherapy (3,4).

Radiotherapy is considered the standard treatment for localized forms, achieving complete response rates of over 90% at doses of 20-36 Gy (5-7).

However, local or multifocal recurrence is not uncommon and may warrant re-irradiation (9). This raises important questions regarding tissue tolerance, technical feasibility, and cumulative dose, particularly in elderly or polymorbid patients (10–13).

Innovation in radiotherapy and advances in irradiation techniques, particularly three-dimensional intensity-modulated radiotherapy (IMRT), volumetric modulated arc therapy (VMAT), and tomotherapy, have led to improved dose homogeneity and reduced tissue sparing. Volumetric modulated arc therapy (VMAT) and tomotherapy have enabled greater dose homogeneity and optimized sparing of healthy tissue, opening the possibility of more effective and safer re-irradiation (9,10,14–17).

Tomotherapy combines helical intensity modulation and daily control using integrated imaging (MV-CT), ensuring millimeter-level positioning accuracy and a significant reduction in irradiation margins and toxicity risk (15–17).

The tolerable cumulative dose for skin tissue in re-irradiation remains debated, but several studies suggest that re-irradiation at moderate doses of 20–30 Gy can be performed without a major increase in toxicity. The prescribed surface dose needs to be homogeneous and doses to critical volumes to be strictly respected for avoiding significant toxicity (18,19,22).

In our case, extensive re-irradiation of the right lower limb using 30 Gy in 15 fractions was well tolerated, with no notable side effects, including radiodermatitis, lymphedema, or acute complications, confirming the clinical feasibility of this approach.

The concomitant presence of adenosquamous lung carcinoma highlights the rarity of multiple neoplasms in patients with CLL. These associations may be related to advanced age, immunosuppression, or cumulative carcinogenic exposure (1,2,20,21). The incidental discovery of this second primary cancer led to a personalized and individualized multidisciplinary management strategy, taking into account the constraints of dual cancer and the patient's general condition.

ABBREVIATIONS

CTCL – Cutaneous T-cell lymphoma

PET scan – Positron Emission Tomography Scan

CD 30 – Cluster of Differentiation 30

CTCAE v4 – Common Terminology Criteria for Adverse Events Version 4

3D CRT – 3D conformal radiotherapy

IGRT – Image-Guided Radiation Therapy

Our observation has some limitations, notably its isolated, descriptive nature, which prevents us from drawing more generalizable conclusions or recommendations. Follow-up remains limited, so late side effects could not be assessed.

However, the case illustrates the feasibility and safety of extensive skin re-irradiation using tomotherapy, even in frail, polymorbid elderly patients. It also highlights the value and benefits of rigorous dosimetric planning and daily monitoring using integrated imaging, ensuring both therapeutic efficacy and the preservation of surrounding healthy tissue. This approach could be considered and extended to similar cases, particularly when surgery or chemotherapy is contraindicated, and therapeutic options are limited.

Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

4. Conclusion

Re-irradiation of recurrent cutaneous T-cell lymphomas remains a therapeutic challenge, particularly in elderly patients with multiple comorbidities. Technological advances, such as tomotherapy, now allow highly precise treatments with careful dosimetric planning.

The synchronous lung tumor further highlights the complexity of oncological management and the need for a multidisciplinary approach integrating clinical, technical, and ethical considerations.

Modern radiotherapy techniques, including tomotherapy, therefore represent an effective option for the re-irradiation of locally recurrent cutaneous T-cell lymphomas, contributing to improved local control in frail patients. However, further studies are needed to better understand long-term outcomes, refine treatment strategies, and establish standardized guidelines for this challenging clinical scenario.

ICRU – International Commission on Radiation Units and Measurements

EBUS – Endobronchial Ultrasound

KRAS – Kirsten Rat Sarcoma viral oncogene homolog

MV-CT – Megavoltage Computed Tomography

GTV – Gross Tumor Volume

CTV – Clinical Target Volume

PTV – Planning Target Volume

STATEMENTS

Authors' Contributions: MB conceived and designed the study, coordinated the work, managed the patient, collected and analyzed the data, interpreted the clinical and dosimetric findings, drafted the manuscript, and performed all revisions following the peer-review process. FEA and NT were involved in patient surveillance and data collection. TO participated in patient management and treatment planning, and contributed to the technical aspects of radiotherapy. RH and NB provided supervision and critically reviewed the manuscript.

Consent for publication: All authors approved the final version of the manuscript and agree to be accountable for all aspects of the work.

Patient Consent: The patient provided written and verbal informed consent for the publication of this case report, in accordance with ethical guidelines and the journal's recommendations.

Conflict of Interest: The authors declare no conflicts of interest.

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