

Interesting Images

Clinical Value of ^{18}F -FDG PET in Paraneoplastic and Pembrolizumab-Associated Myositis

Chang-Shen Tseng ¹, Yu-Hung Chen ^{1,2,3,*} , Ching-Chun Ho ⁴, Kuei-Ying Su ⁵, Sung-Chao Chu ^{2,6}  and Shu-Hsin Liu ¹

¹ Department of Nuclear Medicine, Hualien Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, Hualien 970473, Taiwan; 104311113a@gmail.com (C.-S.T.); kaopectin@yahoo.com.tw (S.-H.L.)

² School of Medicine, Tzu Chi University, Hualien 970374, Taiwan; oldguy-chu1129@umail.hinet.net

³ Department of Medical Imaging and Radiological Sciences, Tzu Chi University, Hualien 970374, Taiwan

⁴ Department of Surgery, Hualien Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, Hualien 970374, Taiwan; natalie.hcc@gmail.com

⁵ Division of Allergy, Immunology and Rheumatology, Hualien Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, Hualien 970374, Taiwan; kueiying@gmail.com

⁶ Department of Hematology and Oncology, Hualien Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, Hualien 970374, Taiwan

* Correspondence: jedimasterchen@hotmail.com; Tel.: +886-3-856-1825 (ext. 12024)

Abstract

Fluorine-18 fluorodeoxyglucose positron emission tomography (^{18}F -FDG PET) is widely used to evaluate patients with cancer and to detect various inflammatory processes. Here, we report a rare case of a 53-year-old woman with breast cancer who developed generalized pain, weakness, rash, and edema over the trunk after the first cycle of neoadjuvant pembrolizumab and cytotoxic chemotherapeutic agents. ^{18}F -FDG PET revealed diffusely increased uptake in the muscles without skeletal or visceral metastasis, aiding in the diagnosis of paraneoplastic and pembrolizumab-associated myositis and subsequent monitoring. This case underscores the value of ^{18}F -FDG PET in differentiating myositis from tumor progression and monitoring treatment response in such cases.

Keywords: ^{18}F -FDG PET; myositis; pembrolizumab

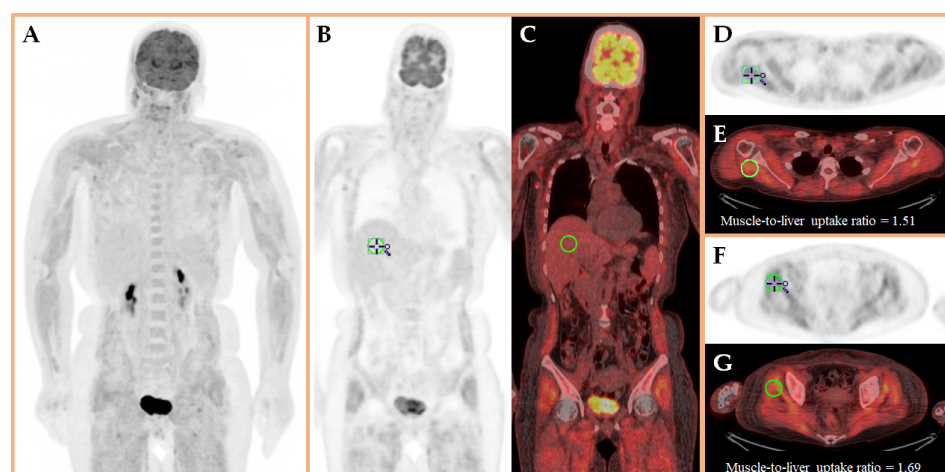


Figure 1. A 53-year-old woman with triple-negative breast cancer (TNBC), classified as cT2N1M0 [1], received neoadjuvant therapy with pembrolizumab and cytotoxic chemotherapeutic agents [2]. After



Academic Editor: Andor W.J.M. Glaudemans

Received: 26 January 2026

Revised: 12 February 2026

Accepted: 13 February 2026

Published: 17 February 2026

Copyright: © 2026 by the authors.

Licensee MDPI, Basel, Switzerland.

This article is an open access article distributed under the terms and conditions of the [Creative Commons Attribution \(CC BY\)](https://creativecommons.org/licenses/by/4.0/) license.

the first cycle, she developed generalized pain, weakness, rash, and edema over the trunk and limbs, eventually becoming bedridden. Fluorine-18 fluorodeoxyglucose positron emission tomography (^{18}F -FDG PET) was performed to rule out disease progression and skeletal metastasis. The patient fasted for at least 4 h before intravenous ^{18}F -FDG injection (400.00 MBq). The patient did not exercise before the injection. We performed the ^{18}F -FDG PET scan from head to thigh 60 min after the radiotracer injection. (A): Maximum Intensity Projection showing diffusely increased uptake in the muscles without skeletal or visceral metastasis. Coronal (B,C) and axial PET and fused PET/CT images showed the scapular (D,E) and gluteal (F,G) muscle-to-liver mean standardized uptake value (SUV_{mean}) ratios of 1.51 and 1.69, respectively. Laboratory tests showed elevated creatine kinase at 1945 U/L (reference range: 30–223 U/L) [3] and positive anti-transcription intermediary factor 1- γ autoantibodies. Taken together, these findings confirmed the diagnosis of paraneoplastic and pembrolizumab-induced myositis [4–6].

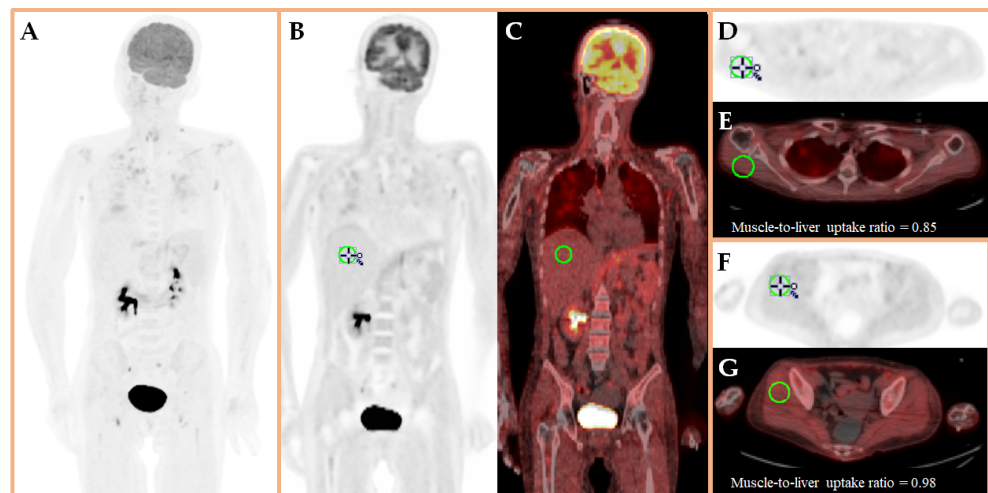


Figure 2. The paraneoplastic and pembrolizumab-induced myositis were treated with intravenous immunoglobulin (2 g/kg) and prednisolone at an equivalent daily dose of 50 mg [7–9]. The prednisolone dose was gradually tapered to 5 mg daily over a two-month period. The patient subsequently underwent a modified radical mastectomy, with a final pathological stage of ypT2N1a. Follow-up ^{18}F -FDG PET performed 5 months after the initial scan revealed reduced muscular ^{18}F -FDG uptake (A–C), with scapular (D,E) and gluteal (F,G) muscle-to-liver SUV_{mean} ratios of 0.85 and 0.98, respectively. The creatine kinase level normalized, and her symptoms gradually subsided. She could walk using a walker and required minimal assistance with self-care. Myositis is a rare comorbidity among patients with TNBC, whether as an immune-related adverse event of pembrolizumab or as a paraneoplastic manifestation. In this case, the onset occurred immediately after the first cycle of pembrolizumab, suggesting that the pembrolizumab may trigger a latent paraneoplastic phenomenon. While serum creatine kinase levels are routinely used as a biomarker of muscle injury, ^{18}F -FDG PET enables direct visualization of inflammatory activities, allows assessment of myositis severity, and assists in distinguishing myositis from cancer metastasis. This case demonstrates the value of ^{18}F -FDG PET as a molecular imaging modality to evaluate patients with cancer with suspected paraneoplastic or immune checkpoint inhibitor-associated myositis.

Author Contributions: Conceptualization, C.-S.T. and Y.-H.C.; methodology, C.-S.T. and Y.-H.C.; investigation, C.-C.H., K.-Y.S., and S.-C.C.; resources, Y.-H.C. and S.-H.L.; data curation, C.-S.T. and Y.-H.C.; writing—original draft preparation, C.-S.T.; writing—review and editing, Y.-H.C.; supervision, Y.-H.C., K.-Y.S., S.-C.C., and S.-H.L. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by Hualien Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, and National Science and Technology Council in Taiwan, grant number 113-2314-B-303-018-MY2.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki and approved by the Research Ethics Committee of Hualien Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation (protocol code: CR115-002 and date: 13 January 2026).

Informed Consent Statement: Written informed consent was obtained from the patient to publish this paper.

Data Availability Statement: The data presented in this study are available on request from the corresponding author due to ethical restrictions.

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

Abbreviations

The following abbreviations are used in this manuscript:

FDG	Fluoro-deoxy-glucose
PET	Positron emission tomography
SUV _{mean}	Mean standardized uptake value
TNBC	Triple-negative breast cancer

References

1. Amin, M.B.; Greene, F.L.; Edge, S.B.; Compton, C.C.; Gershengwald, J.E.; Brookland, R.K.; Meyer, L.; Gress, D.M.; Byrd, D.R.; Winchester, D.P. The Eighth Edition AJCC Cancer Staging Manual: Continuing to build a bridge from a population-based to a more “personalized” approach to cancer staging. *CA Cancer J. Clin.* **2017**, *67*, 93–99. [[CrossRef](#)] [[PubMed](#)]
2. Schmid, P.; Cortes, J.; Pusztai, L.; McArthur, H.; Kummel, S.; Bergh, J.; Denkert, C.; Park, Y.H.; Hui, R.; Harbeck, N.; et al. Pembrolizumab for Early Triple-Negative Breast Cancer. *N. Engl. J. Med.* **2020**, *382*, 810–821. [[CrossRef](#)] [[PubMed](#)]
3. Aleksovska, K.; Kyriakides, T.; Angelini, C.; Argov, Z.; Claeys, K.G.; de Visser, M.; Filosto, M.; Jovanovic, I.; Kostera-Pruszyk, A.; Molnar, M.J.; et al. What Are the Normal Serum Creatine Kinase Values for Skeletal Muscle? A Worldwide Systematic Review. *Eur. J. Neurol.* **2025**, *32*, e70240. [[CrossRef](#)] [[PubMed](#)]
4. De Vooght, J.; Vulsteke, J.B.; De Haes, P.; Bossuyt, X.; Lories, R.; De Langhe, E. Anti-TIF1-gamma autoantibodies: Warning lights of a tumour autoantigen. *Rheumatology* **2020**, *59*, 469–477. [[CrossRef](#)] [[PubMed](#)]
5. Kostine, M.; Truchetet, M.E.; Schaefferbeke, T. Clinical characteristics of rheumatic syndromes associated with checkpoint inhibitors therapy. *Rheumatology* **2019**, *58*, vii68–vii74. [[CrossRef](#)] [[PubMed](#)]
6. Dalakas, M.C.; Hohlfeld, R. Polymyositis and dermatomyositis. *Lancet* **2003**, *362*, 971–982. [[CrossRef](#)] [[PubMed](#)]
7. Danieli, M.G.; Antonelli, E.; Gammeri, L.; Longhi, E.; Cozzi, M.F.; Palmeri, D.; Gangemi, S.; Shoenfeld, Y. Intravenous immunoglobulin as a therapy for autoimmune conditions. *Autoimmun. Rev.* **2025**, *24*, 103710. [[CrossRef](#)] [[PubMed](#)]
8. Ghate, J.; Katsambas, A.; Augerinou, G.; Jorizzo, J.L. Review article: A therapeutic update on dermatomyositis/polymyositis. *Int. J. Dermatol.* **2000**, *39*, 81–87. [[CrossRef](#)] [[PubMed](#)]
9. Jayan, A.; Mammen, A.L.; Suarez-Almazor, M.E. Immune Checkpoint Inhibitor-induced Myositis. *Rheum. Dis. Clin. N. Am.* **2024**, *50*, 281–290. [[CrossRef](#)] [[PubMed](#)]

Disclaimer/Publisher’s Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.