CASE REPORT

Detection of soft tissue metastasis in a Grade-1 Neuroendocrine Tumor: a case report using both [^{68}Ga]Ga-DOTANOC PET/CT and indigenous [^{99m}Tc]Tc-HYNIC-TATE SPECT/CT

Muhammad Hamza Hayat[1*], Nayyar Rubab[1], Syed Fakhar Raza[1], Muhammad Talha[1], Muhammad Babar Imran[1]

Pakistan Journal of Nuclear Medicine
Volume 15(1):37–41
DOI: 10.24911/PJNMed.175-1759152750

Pakistan Journal of Nuclear Medicine is the official journal of Pakistan Society of Nuclear Medicine

ABSTRACT

Background: Neuroendocrine tumors (NETs) are often well-differentiated and express somatostatin receptors (SSTRs), making functional imaging essential for accurate localization and staging. While [^{68}Ga]Ga-DOTANOC PET/CT is preferred for its superior sensitivity, [^{99m}Tc]Tc-HYNIC-TATE SPECT/CT offers a viable alternative in settings with limited positron emission tomography (PET) access.

Case Description: We report a case of a 44-year-old patient diagnosed with a Grade 1 NET on tru-cut biopsy from retroperitoneal mass. To evaluate disease extent and SSTR expression, [^{68}Ga]Ga-DOTANOC PET/CT and [^{99m}Tc]Tc-HYNIC-TATE SPECT/CT were performed. Both imaging modalities demonstrated concordant findings with significant tracer uptake in a subhepatic lesion, retroperitoneal lymph nodes, and a hepatic lesion in segment V of the liver. These results confirmed the presence of both primary and metastatic disease, as well as high SSTR expression, indicating suitability for somatostatin analog therapy and possibly peptide receptor radionuclide therapy (PRRT).

Conclusion: This case illustrates that while [^{68}Ga]Ga-DOTANOC PET/CT remains the gold standard of imaging, [^{99m}Tc]Tc-HYNIC-TATE SPECT/CT is a reliable alternative, particularly when PET is not available. The concordance between both modalities reinforces the diagnostic utility of [^{99m}Tc]Tc-HYNIC-TATE SPECT/CT in clinical practice.

Received: 29 September 2025 **Revised:** 03 November 2025 **Accepted:** 04 November 2025
Address for correspondence: Muhammad Hamza Hayat
*Clinical Trainee, Nuclear Medicine Department, PINUM Cancer Hospital, Faisalabad, Pakistan.
Email: hamzahayat997@gmail.com
Full list of author information is available at the end of the article.

Introduction

Neuroendocrine tumors (NETs) are characterized by neuroendocrine differentiation and frequent expression of somatostatin receptors [1]. Accurate localization and staging are essential to guide management and assess prognosis. Imaging modalities such as [^{68}Ga]Ga-labelled DOTA peptides with PET/CT are considered the gold standard of imaging for detecting primary, metastatic, and occult lesions due to superior sensitivity and resolution [2]. However, in many centres, [^{99m}Tc]Tc-labelled somatostatin receptor imaging (such as [^{99m}Tc]Tc-HYNIC-TATE remains in use because of comparable sensitivity, greater availability, and lower cost. We present a case of a Grade-1 NET in a 44-year-old patient with concordant findings on both modalities, demonstrating both the utility, cost effectiveness, and comparable sensitivity of [^{99m}Tc]Tc-HYNIC-TATE in grade 1 neuroendocrine tumor [3].

Case Presentation

A 44-year-old male patient was referred to Nuclear Medicine OPD for [^{99m}Tc]Tc-HYNIC-TATE imaging. His biopsy taken from the retroperitoneal mass revealed a neuroendocrine tumor grade 1 with 3% Ki index. The patient had completed eight cycles of octreotide therapy, with the last dose administered in May 2025. Despite ongoing therapy, clinical and imaging evaluations indicate progressive disease. In view of this, the treating oncologist referred the patient to assess the sustainability for [^{177}Lu]Lu-DOTA-TATE therapy. His [^{68}Ga]Ga-PET/CT showed a DOTA-avid hepatic lesion in segment V of the liver, a retroperitoneal and sub-hepatic lesion. To evaluate the potential utility of [^{99m}Tc]Tc-HYNIC-TATE imaging in a setting where PET/CT is not available, we performed [^{99m}Tc]Tc-HYNIC-TATE scan for parallel comparison.

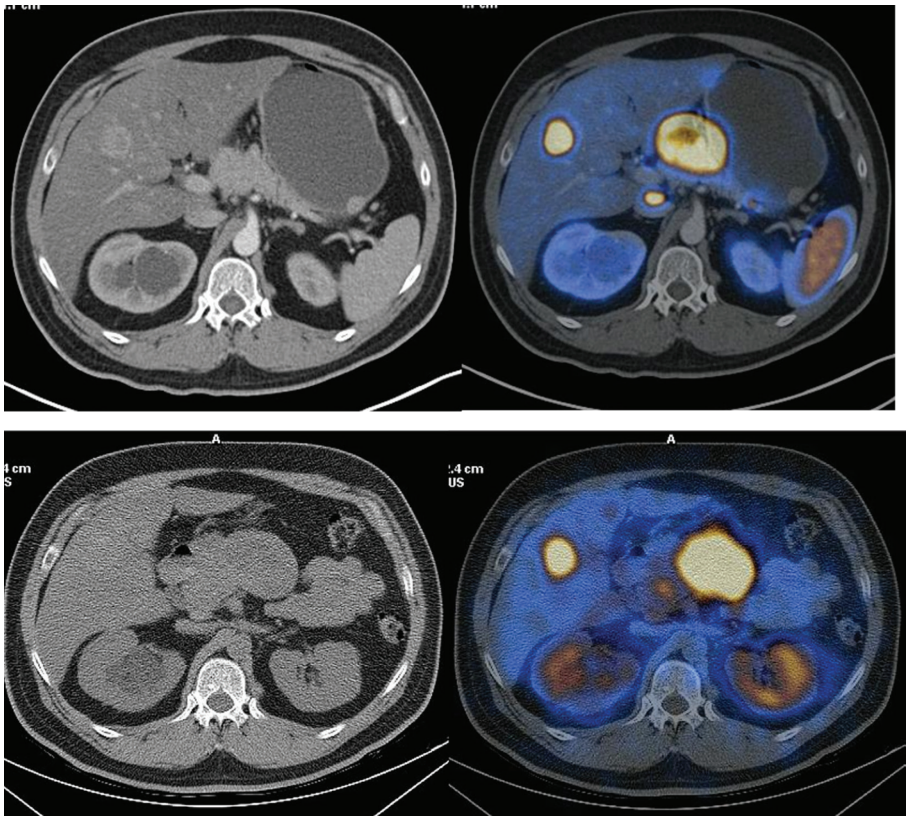

Figure 1. *A: [^{68}Ga]Ga-DOTANOC PET/CT demonstrate tracer avid lesion in segment V of liver and sub-hepatic region. B: [^{99m}Tc]Tc-HYNC-TATE demonstrate tracer avid lesion in segment V of liver and sub-hepatic region.*

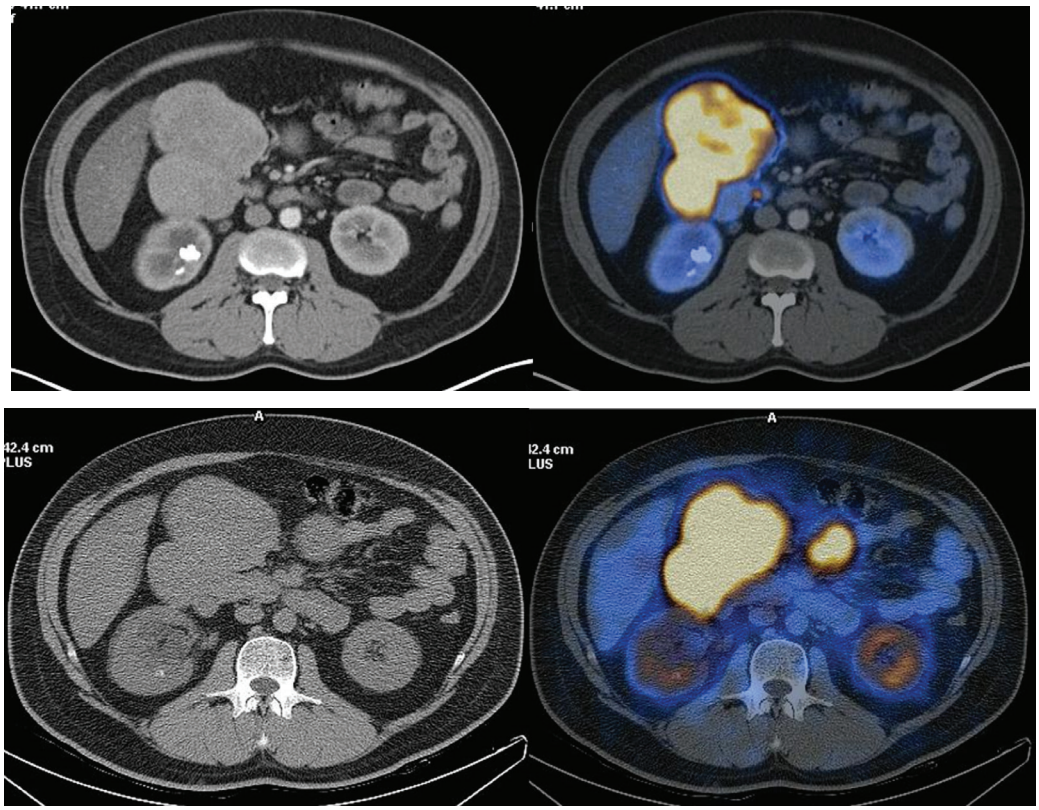

Figure 2. *A: [^{68}Ga]Ga-DOTANOC PET/CT demostrate tracer avid lesion in retroperitoneal lymph nodes. B: [^{99m}Tc]Tc-HYNICTATE scan demonstrate tracer-avid lesion in retroperitoneal lymph nodes*

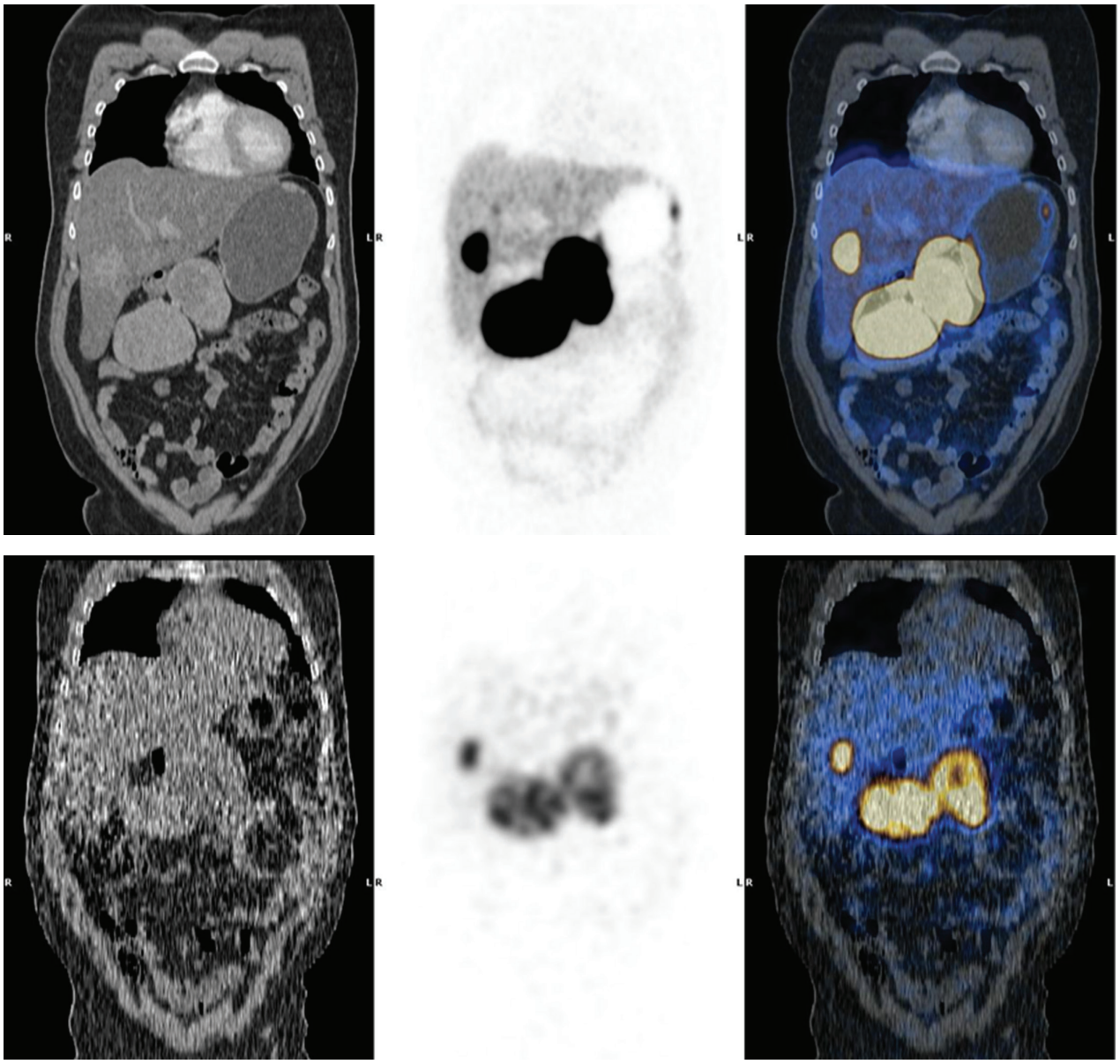

Figure 3. *A: Coronal section of disease burden on [^{68}Ga]Ga-DOTA-NOC PET/CT showing retroperitoneal, sub hepatic, and liver segment V lesion. B: Coronal section of disease burden on [^{99m}Tc]Tc-HYNIC-TATE SPECT/CT showing retroperitoneal, sub hepatic, and liver segment V lesion.*

Imaging findings

[^{68}Ga]Ga-DOTANOC PET/CT: The image was acquired after administering 5 mCi [^{68}Ga]Ga- DOTA-NOC. The scan revealed tracer avid lesion in the sub-hepatic region, DOTA-avid gastric lesion, involvement of retroperitoneal lymph nodes, DOTA-avid hepatic lesion in segment V, mildly avid lytic lesion in T6 vertebra, and avid-right adrenal nodule, as shown in Figures 1a, 2a, and 3a.

[^{99m}Tc]Tc-HYNIC-TATE SPECT/CT: The image was acquired after administrating 15 mCi [^{99m}Tc]Tc-HYNIC-TATE. Concordant findings in the sub-hepatic region, gastric lesion, involvement of retroperitoneal lymph nodes and tracer avid hepatic lesion in segment V was seen. Discordant lesions were a mildly avid lytic lesion in T6 and a right adrenal nodule, as shown in Figures 1b, 2b, and 3b.

Discussion

PET/CT imaging with [^{68}Ga]Ga-DOTA-NOC is regarded as a gold standard of imaging for detecting somatostatin receptor-expressing lesions because of its high sensitivity, especially for small primary tumors, extra-hepatic metastases, and bone involvement. In many studies, DOTA-NOC binds with high affinity not only to SSTR2 but also to SSTR3 and SSTR5, giving it broader coverage of receptor subtypes and allowing it to localize more lesions than other selective somatostatin analogs [4]. In clinical cohorts, [^{68}Ga]Ga-DOTANOC PET/CT has been shown to detect a larger number of metastatic sites compared to conventional imaging, particularly in the liver, bone, and lymph nodes, often leading to upstaging or changes in management [5]. In our particular case, PET/CT localized the primary lesion and identified multiple metastatic foci,

giving a comprehensive whole-body picture of disease burden. The [^{99m}Tc]Tc-HYNIC-TATE SPECT/CT in turn demonstrated concordant findings, as the same lesions showed uptake in the SPECT/CT, reinforcing the presence of SSTR expression in each site, which is critical when deciding on receptor-targeted therapies such as PRRT.

From a technical and practical standpoint, the advantages of [68Ga]Ga-DOTA-NOC PET/CT include higher spatial resolution, as PET has inherently better resolution than gamma-camera or SPECT systems, allowing detection of smaller lesions [6]. PET also provides quantification capabilities by enabling the measurement of standardized uptake values (SUVs), which aid in assessing lesion activity, comparing between serial scans, and guiding therapeutic planning [6]. Moreover, the combination of higher resolution and better signal-to-noise improves lesion detectability, allowing PET to pick up smaller or lower-uptake lesions that might be below the SPECT threshold. This contributes to more accurate staging, as [^{68}Ga]Ga- DOTA-NOC PET/CT often reveals additional metastatic lesions beyond conventional imaging, such as occult bone metastases, which can alter staging and treatment decisions [5]. Additionally, PET quantification helps in estimating receptor density and heterogeneity, which is relevant for selecting patients for PRRT [7].

Nevertheless, PET with [^{68}Ga]Ga-DOTA-NOC also has disadvantages and constraints. It is associated with high cost, as PET scanners, maintenance, and radiopharmaceutical production are expensive. Its availability is limited because [^{68}Ga]Ga generators, synthesis modules, and radiochemistry expertise are required. Radiotracer infrastructure also poses challenges since [^{68}Ga]Ga has a relatively short half-life of around 68 minutes, necessitating careful radiochemistry timing, rapid synthesis, and on-site production or a nearby supply chain. Furthermore, there is the possibility of false negatives in low-receptor expressing lesions, as some tumors may not express sufficient somatostatin receptors, particularly in more dedifferentiated or aggressive disease, leading to underestimation of the disease process. Radiation dose and logistical challenges, while acceptable, are also factors, as PET/CT involves a higher cost and greater complexity in patient workflow and dosimetry.

On the other hand, [^{99m}Tc]Tc-HYNIC-TATE SPECT/CT offers several advantages, especially in resource-limited settings. It is more widely available, since many nuclear medicine centres already possess gamma cameras, SPECT/CT systems, and expertise with Technetium-99m [^{99m}Tc]Tc tracers. The costs are lower, as radiopharmaceutical production and required infrastructure are less complex and less expensive. Radiochemistry and logistics are more established, with [^{99m}Tc]Tc being a workhorse isotope in nuclear medicine, supported by widely available kits and well-developed supply chains. Imaging with [^{99m}Tc]Tc also offers lower background and favourable dosimetry compared to older isotopes such as In-111, which were previously used in somatostatin receptor imaging [8]. Furthermore, hybrid SPECT/CT provides functional uptake data combined with anatomical CT localization, improving lesion localization and reducing ambiguities [7].

Despite these advantages, this modality has limitations. Its spatial resolution and sensitivity are lower compared to PET, which makes detecting small or low-uptake lesions more difficult. Quantification is less reliable, since while semi-quantitative indices such as lesion-to-background ratios may be applied, accurate SUVs, as in PET, are not routinely available in Single Photon Emission Computed Tomography. There is also the possibility of missing very small lesions or those with weak receptor expression, as they may go undetected. Additionally, artifacts, photon attenuation, and scatter can degrade image quality and lesion detectability, while the lower dynamic range of SPECT imaging results in poorer contrast between lesion uptake and background, reducing the conspicuity of borderline lesions.

From a clinical perspective in Pakistan and other low- to middle-income countries, the use of a more available and affordable modality such as [^{99m}Tc]Tc-HYNIC-TATE is strongly justified, particularly when PET is not accessible. Demonstrating concordance - i.e., matching lesions - between [^{68}Ga]Ga-DOTA-NOC PET/CT and [^{99m}Tc]Tc-HYNIC-TATE SPECT/CT in clinical cases reinforces the notion that [^{99m}Tc]Tc-HYNIC-TATE can reliably detect clinically relevant lesions in many patients.

Conclusion

This case illustrates that both [^{68}Ga]Ga-DOTA-NOC PET/CT and [^{99m}Tc]Tc-HYNIC-TATE SPECT/CT can provide concordant localization of NET Grade-1 lesions, including primary and metastatic sites. While [^{68}Ga]Ga PET/CT remains superior, especially for small lesions, [^{99m}Tc]Tc-based SPECT/CT proves to be a viable imaging alternative in settings with limited resources, as it is cost-effective, has equivocal sensitivity, and is easily available.

Conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this article.

Funding

None.

Consent for publication

Due permission was obtained from the patient/parents/guardians of the patient to publish the case and the accompanying images.

Ethical approval

Ethical approval is not required at our institution to publish an anonymous case report.

Author details

Muhammad Hamza Hayat[1], Nayyar Rubab[1], Syed Fakhar Raza[1], Muhammad Talha[1], Muhammad Babar Imran[1]

1. Nuclear Medicine Department, PINUM Cancer Hospital, Faisalabad, Pakistan

References

1. Hofland LJ, Lamberts SWJ. Somatostatin receptor subtype expression in human tumors. Ann Oncol. 2001;12 Suppl 2(Suppl 2):S31–6. https://doi.org/10.1093/annonc/12.suppl_2.S31
2. Etchebehere ECSDC, De Oliveira Santos A, Gumz B, Vicente A, Hoff PG, Corradi G, et al. 68Ga-DOTATATE PET/CT, 99mTc-HYNIC-octreotide SPECT/CT, and whole-body MR imaging in detection of neuroendocrine tumors: a prospective trial. J Nucl Med. 2014;55:1598–604. https://doi.org/10.2967/jnumed.114.144543
3. Kim JY, Hong SM, Ro JY. Recent updates on grading and classification of neuroendocrine tumors. Ann Diagn Pathol. 2017;29:11–6. https://doi.org/10.1016/j.anndiagpath.2017.04.005
4. Singh D, Arya A, Agarwal A, Agarwal G, Ravina M, Gambhir S. Role of Ga-68 DOTANOC positron emission tomography/computed tomography scan in clinical management of patients with neuroendocrine tumors and its correlation with conventional imaging - experience in a tertiary care center in India. Indian J Nucl Med. 2022;37:29–36. https://doi.org/10.4103/ijnm.ijnm_109_21
5. Lugat A, Frampas E, Touchefeu Y, et al. Prospective multicentric assessment of 68Ga-DOTANOC PET/CT in grade 1-2 GEP-NET. Cancers (Basel). 2023;15:513. https://doi.org/10.3390/cancers15020513
6. Raj N, Reidy-Lagunes D. The role of 68Ga-DOTATATE positron emission tomography/computed tomography in well-differentiated neuroendocrine tumors: a case-based approach illustrates potential benefits and challenges. Pancreas. 2018;47:1–5. https://doi.org/10.1097/MPA.0000000000000949
7. Sanli Y, Garg I, Kandathil A, Kendi T, Zanetti MJB, Kuyumcu S, et al. Neuroendocrine tumor diagnosis and management: 68Ga-DOTATATE PET/CT. AJR Am J Roentgenol. 2018;211:267–77. https://doi.org/10.2214/AJR.18.19881
8. Deveci EK, Ocak M, Bozkurt MF, Türker S, Kabasakal L, Uğur O. The diagnostic efficiency of 99mTc-EDDA/HYNIC-Octreotate SPECT-CT in comparison with 111In-Pentetrotide in the detection of neuroendocrine tumours. Mol Imag Radionucl Ther. 2013;22:76–84. https://doi.org/10.4274/Mirt.68552