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Identification of Metastatic Niches in Patients with High-Grade Neuroendocrine Tumors

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Abstract

Metastasis is a critical determinant of prognosis and treatment strategies in patients with high-grade neuroendocrine tumors (NETs). The identification of metastatic niches within the body is essential for accurate staging and personalized therapy. Traditional imaging techniques have limitations in detecting small metastases and differentiating them from benign lesions. In this context, nuclear medicine sequence imaging, including positron emission tomography (PET) and single-photon emission computed tomography (SPECT), has emerged as a promising tool. This article provides an overview of the latest advancements in the identification of metastatic niches in high-grade NETs. Specifically, the use of triple-positive radiolabelled molecular probes in nuclear medicine sequence imaging is highlighted. These probes target multiple biomarkers expressed on high-grade NET cells, enhancing specificity and reducing false-positive results. By accurately identifying metastatic niches, clinicians can optimize treatment decisions and offer targeted therapies such as peptide receptor radionuclide therapy (PRRT) or selective internal radiation therapy (SIRT). The identification of metastatic niches through nuclear medicine sequence imaging holds significant clinical implications, improving staging accuracy, treatment planning, and monitoring of disease progression. Further research in this field promises to advance our understanding and management of high-grade NETs, ultimately improving patient outcomes.

Keywords: Selective internal radiation therapy; Neuro endocrine tumors; Peptide receptor radionuclide therapy; Single-photon emission computed tomography

Introduction

High-grade neuroendocrine tumors (NETs) represent a complex and aggressive form of cancer, characterized by rapid growth and a propensity for metastasis [1]. Metastatic spread significantly affects prognosis and treatment decisions in patients with high-grade NETs. Understanding the specific metastatic niches within the body is crucial for effective management and targeted therapies. In this article, we explore the latest advancements in the identification of metastatic niches in patients with high-grade neuroendocrine tumors, shedding light on their clinical significance and potential implications for personalized treatment strategies [2]. Metastasis is a multistep process involving the dissemination of tumor cells from the primary site to distant organs or tissues. High-grade NETs can metastasize to various locations, including the liver, lungs, bones, and lymph nodes. Identifying these metastatic niches is essential for accurate staging and treatment planning [3]. Traditional imaging techniques, such as computed tomography (CT) and magnetic resonance imaging (MRI) , have limitations in detecting small metastases or differentiating them from benign lesions. Therefore, innovative approaches are being explored to improve the identification and characterization of metastatic niches [4].

Discussion

Nuclear medicine sequence imaging, including positron emission tomography (PET) and single-photon emission computed tomography (SPECT), has emerged as a valuable tool in the identification of metastatic niches in high-grade NETs [5]. These techniques utilize radiolabelled molecular probes that specifically target neuroendocrine tumor cells, facilitating their visualization and precise localization within the body. In recent years, the development of triple-positive radiolabelled molecular probes has significantly improved the sensitivity and accuracy of nuclear medicine sequence imaging for identifying metastatic niches [6].

Triple-positive radiolabelled molecular probes are designed to target multiple biomarkers expressed on high-grade NET cells. By combining different molecular targets, these probes enhance specificity and reduce false-positive results. Commonly targeted biomarkers include somatostatin receptors (SSTR), glucose transporters (GLUT), and receptors for gastrin-releasing peptide (GRP) [7]. The radiolabelled probes bind to these receptors, allowing for the detection and visualization of neuroendocrine tumor cells even in small metastatic lesions. Accurate identification of metastatic niches in high-grade NETs has significant clinical implications [8]. It enables precise staging, aids in treatment decision-making, and assists in monitoring disease progression and response to therapy. Metastatic lesions identified through nuclear medicine sequence imaging can be targeted with site-specific therapies, such as peptide receptor radionuclide therapy (PRRT) or selective internal radiation therapy (SIRT) [9]. These approaches deliver high-dose radiation directly to the metastatic lesions, sparing healthy tissue and improving treatment outcomes [10].

Conclusion

The identification of metastatic niches in patients with high-grade neuroendocrine tumors is crucial for optimal disease management. Nuclear medicine sequence imaging, particularly with triple-positive radiolabelled molecular probes, has emerged as a promising tool for detecting and characterizing metastatic lesions with high sensitivity and specificity. By accurately identifying metastatic niches, clinicians can tailor treatment strategies, offering targeted therapies and

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improving patient outcomes. Continued research and technological advancements in this field hold the promise of further enhancing our understanding and management of high-grade Nets. Several molecular biomarkers used for CSCs identification showed signatures variation in a single tumors type, as well as common/overlapped signatures between different types of solid tumors. Also, it is common to perform multiple biopsies because of evolving differentiation grades in primary and metastatic tumour sites, especially in G3 NETs and NECs of the digestive tract. The hypothesis of a dynamic transition of cell states and tumour evolution differs from the concept of heterogeneity in a tumour sample biopsy.

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