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Lymphoscintigraphy in Sentinel Lymph Node Mapping for Primary Malignant Melanoma of the Male Breast: A Rare Case Report

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Abstract **Case Report**

Primary cutaneous malignant melanoma of the breast is an exceptionally rare neoplasm, particularly in male patients. Although it shares clinicopathological features with melanomas from other cutaneous sites, its atypical location often complicates diagnosis and staging. Regional lymph node involvement remains the most important prognostic factor in melanoma, making accurate identification of sentinel lymph nodes (SLNs) a critical step in management. We report a rare case of primary cutaneous malignant melanoma of the breast in a male patient. Due to the rarity of this presentation, careful staging was necessary to guide therapeutic decisions. Lymphoscintigraphy was employed for sentinel lymph node mapping. This enabled a targeted sentinel lymph node biopsy (SLNB), avoiding unnecessary axillary lymph node dissection. This case underscores the critical role of lymphoscintigraphy in the staging and management of primary cutaneous malignant melanoma of the breast, especially in male patients. By facilitating precise SLN localization, lymphoscintigraphy improves staging accuracy, supports individualized treatment planning, and reduces the morbidity associated with more extensive surgical procedures. Its integration into the diagnostic workflow is essential for optimizing outcomes in rare and anatomically uncommon melanoma presentations.

Keywords: Primary cutaneous malignant melanoma, Male breast melanoma, Lymphoscintigraphy, Sentinel lymph node biopsy, Lymph node mapping.

INTRODUCTION

Malignant melanoma is the malignant neoplasm of melanocytes and nevus cells that occurs predominantly in the skin and other less common sites, Malignant melanoma of the breast has various manifestations: primary cutaneous melanoma, primary glandular melanoma, metastatic melanoma, and in-transit metastases to the breast [1,3]. however, Primary cutaneous malignant melanoma of the breast is an exceedingly rare clinical entity and particularly uncommon in males.

Primary cutaneous malignant melanoma of the breast exhibits clinical characteristics comparable to those of melanomas arising in other cutaneous sites [3]. In the metastatic process, the initial spread typically involves the regional lymph nodes. The first lymph node, or cluster of nodes, to receive lymphatic drainage from the tumor is termed the sentinel lymph node (SLN), which represents the principal target of lymphoscintigraphy.

Lymphoscintigraphy assesses obstruction, flow, and malignancy in lymph nodes. The theory of lymph node mapping entails injecting a radioactive tracer and performing imaging to follow the route of the tracer, determine where it builds up, and see how far it can travel [4].

This knowledge defines the route of potential treatment and the prognosis for melanoma patients. The presence of regional lymph node involvement is the single most important prognostic factor [5].

This case report presents a rare instance of primary cutaneous malignant melanoma of the breast in a male patient. The purpose of this report is to highlight and discuss the utility of lymphoscintigraphy as the staging modality of choice for melanomas and breast cancers and its role in providing better local disease

control and reducing the morbidity associated with axillary lymph node dissection.

Case Presentation

A 58-year-old male patient and active smoker presented with a nodular lesion in the right nipple-areolar region, first noted two years ago. The lesion had been repeatedly manipulated by the patient and has progressively become indurated over the past six months. Throughout this period, the patient's general condition remained stable. clinical examination revealed a hyperpigmented infiltrated and indurated lesion measuring 0.5 cm on the right breast, adherent to the nipple and areolar plate. There were no palpable masses in the breast, no palpable axillary or supraclavicular lymphadenopathy and no other suspicious cutaneous lesions identified.

Histopathological and immunohistochemical analysis following a biopsy confirmed malignant melanoma. For staging investigations, further assessment was carried out using a positron emission tomography/CT (PET/CT) scan, which revealed no evidence of distant metastasis.

To assess regional lymphatic involvement, lymphoscintigraphy was performed one day before surgery, using peritumoral intradermal injections of Technetium-99m labeled nanocolloid, the dose of 2 mci was divided equally among 4 injections surrounding the lesion. Preoperative lymphoscintigraphy was performed on a Gamma-camera. Static images, centered on the thorax in anterior, profile and anterior oblique incidences 1h after radiotracer injection, identified sentinel lymph nodes (SLNs) in the right axilla region. The anterior and lateral projections of the sentinel node were marked on the skin, using an indelible pencil, after breast bandaging, with the arm positioned at 90°. The patient underwent a radical excision of the nipple-areolar region in addition to sentinel lymph node biopsy. During surgery, a gamma probe was used to locate and excise the axillary sentinel lymph node. Histopathologic examination showed no evidence of metastatic melanoma (pN0). The tumor was staged as pT4b N0 Mx with 10 mm in Breslow thickness, no adjuvant therapy was initiated given the absence of nodal or distant spread. The patient entered a structured follow-up program, including clinical exams and imaging at regular intervals.

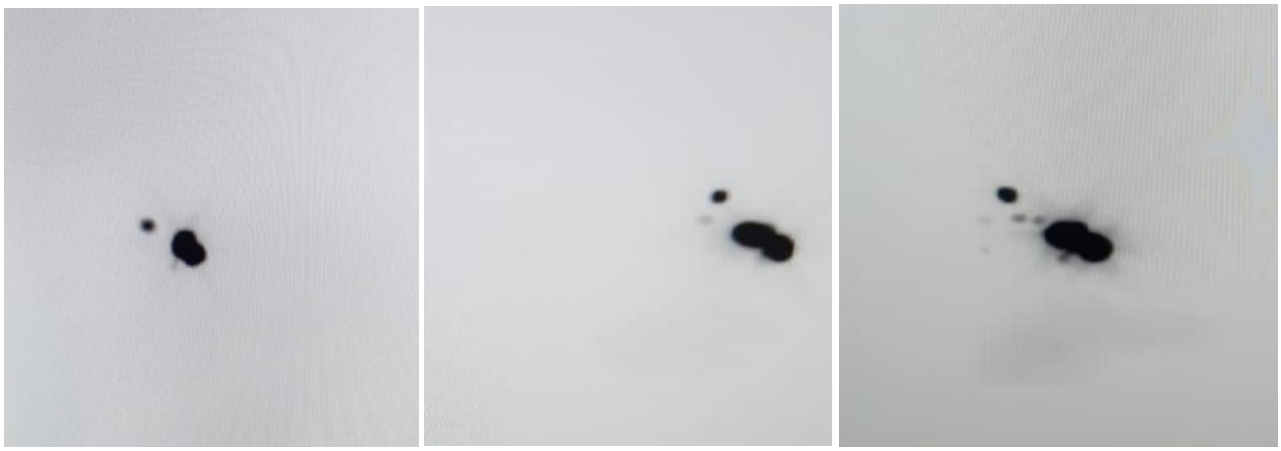

Figure 1: Anterior, profile and right anterior oblique incidences of melanoma and sentinel lymph nodes

Figure 2: Anterior, profile and right anterior oblique incidences of sentinel lymph nodes only

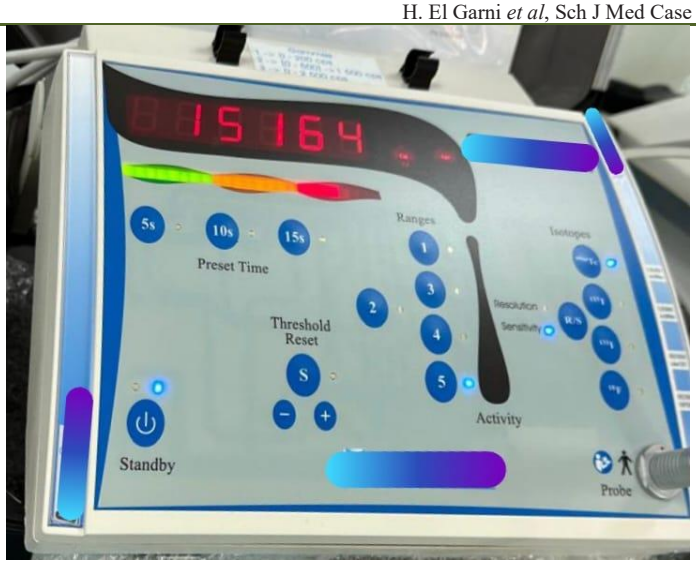

Figure 3: The gamma probe system used for intra-operative detection

DISCUSSION

Melanomatous lesions of the breast may present either as metastatic disease originating from a primary cutaneous melanoma or, less commonly, as a primary malignant melanoma of the breast (PMMB) [1,6]. It is noteworthy that melanoma represents the most frequent extramammary solid malignancy to metastasize to the breast [6]. Nonetheless, PMMB remains an exceedingly rare clinical entity, accounting for approximately 3–5% of all melanoma cases and less than 0.5% of malignant breast neoplasms [1,7,8,9]. In male breast, primary malignant melanoma is an unusual presentation.

Primary cutaneous melanoma exhibits a strong predilection for regional lymphatic dissemination, often metastasizing to the draining lymph node basins. In patients without clinically evident lymphadenopathy, the pretest probability of macroscopic nodal involvement remains low, thereby limiting the diagnostic utility of PET/CT imaging in this setting. Accordingly, sentinel lymph node biopsy (SLNB) is regarded as the standard staging modality due to its superior sensitivity in detecting occult (microscopic) nodal metastases [10,11].

In the current study, sentinel lymph node biopsy (SLNB) remains a key staging tool for patients with primary cutaneous melanoma measuring ≥1 mm in Breslow thickness, consistent with existing guidelines, Sentinel node metastasis has been reported in 12% to 20% of melanomas measuring 1 to 2 mm in thickness, 28% to 33% of those measuring 2 to 4 mm, and 28% to 44% of melanomas greater than 4 mm in thickness [12,13]. However, in patients with thin melanomas (<1 mm), the decision to perform SLNB should be individualized, as several histopathological and demographic factors have been associated with an increased risk of nodal metastasis. These include ulceration, Breslow thickness >0.75 mm, Clark level IV invasion, a mitotic rate >0/mm² [14–15], younger patient age, and male sex [16]. Incorporating these risk factors into clinical decision-making may help optimize patient selection for SLNB and avoid unnecessary procedures in truly low-risk cases.

Accurate preoperative lymphoscintigraphy (LSG) plays a critical role in the successful execution of sentinel lymph node biopsy (SLNB). As the initial step in lymphatic mapping, LSG provides essential imaging that delineates the lymphatic drainage pathways from the primary tumor site, based on the principle of a stepwise and orderly progression of tumor cells through the lymphatic system, typically without bypassing intermediary nodes. Consequently, if the SLN—the first node to receive lymphatic drainage from the primary tumor—is free of metastatic involvement, there is a high likelihood that the remaining nodes in the relevant primary and subsequent basins will also be uninvolved by malignancy [17].

The procedure for lymphoscintigraphy and sentinel lymph node biopsy (SLNB) typically comprises interstitial injection of a radiopharmaceutical tracer, followed by preoperative scintigraphic imaging to visualize lymphatic drainage pathways, and intraoperative localization using a handheld gamma probe to guide surgical excision of radioactive lymph nodes. The effectiveness of this technique relies on the intrinsic capacity of the lymphatic system to transport macromolecules from the interstitial compartment toward the central vascular circulation, enabling targeted identification of sentinel nodes based on tracer uptake [5].

A variety of radiotracers are available for sentinel lymph node mapping. Among these, technetium-99m–labeled colloid remains the most commonly employed radiotracer in clinical practice, and it was the radiotracer employed in the present case. Technetium-99m–labeled colloids demonstrate slower clearance from the injection site compared to other macromolecules and

provide less detailed visualization of lymphatic vessels. Nonetheless, due to their enhanced retention within lymph nodes, colloidal suspensions are more effective for lymph node mapping and are therefore preferred for this application [5].

Given the low administered dose of radioactivity, the resulting radiation exposure to the patient is minimal, thereby posing negligible risk [5].

The injection technique is crucial to ensure optimal tracer distribution and accurate lymphatic mapping [18], in this case; the dose is divided equally among 4 peritumoral intradermal injections. 30 to 60 min after radiotracer injection, static images -depending on the region of interest-, of any visualized lymph nodes are taken for 5–10 min.

The cutaneous projection of the sentinel lymph nodes is marked by the nuclear medicine physician to facilitate intraoperative localization by the surgeon. It is therefore essential that skin marking be performed with the patient positioned identically to the anticipated surgical setup, ensuring anatomical consistency between imaging and operative fields [17].

In the operating room, a hand-held gamma probe is employed to intraoperatively detect gamma emissions from radiolabeled sentinel lymph nodes. This device provides real-time count rates, enabling precise localization of radioactive nodes and thereby guiding the surgical dissection. Its use significantly reduces the extent of tissue dissection required, enhancing both accuracy and surgical efficiency [17].

Lymphoscintigraphy and Sentinel lymph node biopsy are associated with low morbidity. Reported complications include wound dehiscence (0.2%–1.2%), lymphedema (0.6%–0.7%), seroma or hematoma formation (2.3%–5.5%), and surgical site infection (1.1%–4.6%) [19,20]. Moreover, quality of life assessments has consistently demonstrated that the procedure is generally well tolerated by patients [21].

Conclusion

Primary malignant melanoma of the breast is an exceptionally rare diagnosis, particularly in male patients, often presenting diagnostic and therapeutic challenges due to its atypical location and clinical ambiguity. In this case, lymphoscintigraphy plays a pivotal role in the accurate staging and management of the disease. By enabling precise identification of sentinel lymph nodes, lymphoscintigraphy facilitates targeted biopsy, thereby providing critical prognostic information while minimizing the morbidity associated with complete lymph node dissection.

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