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Original Article

Utility of single photon emission computed tomography–computed tomography in selective sentinel lymph node biopsy in patients with melanoma☆

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ABSTRACT

Objective: To assess the contribution of SPECT–CT lymphoscintigraphy in selective sentinel lymph node biopsy (SLNB) in patients with newly diagnosed malignant melanoma.
Material and methods: A prospective study was made between July 2009 and October 2010. It included 63 patients diagnosed with melanoma (32 men and 31 women) with mean age of 55 years (range: 25–88) and inclusion criteria for SLNB. The melanomas were located as follows: 28 in trunk, 5 in head and neck, 16 in upper limbs and 17 in lower limbs. Three patients had two melanomas. Preoperative lymphoscintigraphy was performed after pericicatricial/perilesional injection of 74 MBq of ^{99m}Tc-labeled nanocolloid human serum albumin, obtaining early planar images, late whole body study and sectorial images and SPECT–CT in the area of interest. Planar scintigraphy findings were compared with SPECT–CT.
Results: The sentinel node (SN) was localized by planar imaging in 62/63 (98%) patients. SPECT–CT study located the SN in all the patients with a detection rate of 100%. The number of SNs detected with SPECT–CT was higher than that with the planar study in 27 patients. The SPECT–CT provided additional information (change in location and/or in its accuracy in the localization of location uncertain SN) in 14/63 (22.2%) patients, involving changes in the surgical approach and lymph node staging.
Conclusion: SPECT–CT detects a higher number of SN than planar lymphoscintigraphy in patients with melanoma. Its contribution is more relevant in the melanomas located on the trunk, head and neck. SPECT–CT modified the SN location by 22% compared to planar scan findings, facilitating a correct surgical approach.

Utilidad de la tomografía de emisión de fotón único-tomografía computarizada en la biopsia selectiva del ganglio centinela en pacientes con melanoma

Palabras clave:
Tomografía de emisión de fotón único-tomografía computarizada
Linfogammagrafía
Ganglio centinela
Melanoma

RESUMEN

Objetivo: Evaluar la aportación de la linfogammagrafía con SPECT-TAC en la biopsia selectiva del ganglio centinela (BSGC) en pacientes con melanoma.
Material y métodos: Estudio prospectivo (julio de 2009 a octubre de 2010) incluyendo 63 pacientes diagnosticados de melanoma (32 hombres y 31 mujeres), con edad media de 55 años y criterios de inclusión de BSGC. La localización de los melanomas fue: 28 en el tronco, 5 en la cabeza y el cuello, 16 en los miembros superiores y 17 en los miembros inferiores. Tres pacientes presentaban 2 melanomas. Se realizó linfogammagrafía preoperatoria tras la inyección pericicatricial/perilesional de 74 MBq de nanocoloide de albúmina humana marcada con ^{99m}Tc, obteniéndose imágenes planares precoces, estudio tardío de cuerpo completo, imágenes sectoriales y SPECT-TAC de la zona de interés. Se compararon los hallazgos de la gammagrafía planar y la SPECT-TAC.
Resultados: El ganglio centinela (GC) fue localizado mediante las imágenes planares en 62/63 (98%) pacientes. La SPECT-TAC localizó el GC en los 63 pacientes (100%). El número de GC detectados con SPECT-TAC fue superior al estudio planar en 27 pacientes. El estudio SPECT-TAC aportó información adicional (cambio de localización y/o precisión de la misma en GC de ubicación incierta) en 14/63 (22,2%) pacientes, implicando cambios en el abordaje quirúrgico y en la estadificación ganglionar.
Conclusión: La SPECT-TAC detecta mayor número de GC que la gammagrafía planar, siendo más relevante su aportación en los melanomas de tronco y cabeza y en los de cuello. En un 22% modificó la localización del GC respecto a los hallazgos de la gammagrafía planar, facilitando un correcto abordaje quirúrgico.

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Introduction

Melanoma is the most frequent malignant cutaneous tumor causing 90% of the deaths associated with this type of tumor.[1,2] The incidence of melanoma is rising worldwide, varying from 3–5/100,000 inhabitants in Mediterranean countries to 12–20/100,000 inhabitants in Scandinavian countries, with intermittent exposure to ultraviolet radiation being the most important exogenous factor.[3,4]

Lymph node involvement is the most important prognostic factor in these patients and thus, selective sentinel lymph node biopsy (SLNB) is crucial.[5] Regional lymph nodes are the most common initial localization of metastasis, and in most cases these metastases are usually limited to the first lymph node involved in the lymphatic drainage of the tumor, denominated the sentinel lymph node (SLN). Thus, the absence of metastatic involvement of this lymph node can almost definitively exclude the involvement of the remainder of the lymphatic chain, making lymphadenectomy unnecessary.[6] SLNB is a technique with minimum morbidity and allows the identification of subclinical metastasis, providing more precise staging and more adequate treatment.[7,8] Multicenter studies have demonstrated that recurrences and global survival are related to the state of the SLN. Radical lymphadenectomy in patients with a positive SLN improves the disease-free survival but does not affect the global survival of these patients.[9]

Planar images of lymphoscintigraphy allow visualization of the SLN, albeit without precise anatomical localization.[10–12] Different studies have shown that SPECT/CT is able to determine the exact site of the SLN, thereby facilitating its localization during surgery, especially in the anatomical area of the head and neck,[13,14] which, due to the anatomical complexity, the variability in the lymphatic drainage of the zone,[15,16] the large quantity of lymph nodes in close proximity and, on occasions, the proximity of the primary tumor to the SLN may lead to greater difficulty in localizing the SLN and performing adequate resection.

The objective of this study was to evaluate the contribution of SPECT/CT to planar lymphoscintigraphy in the localization and removal of the SLN in patients diagnosed with melanoma.

Material and methods

Patients

We performed a prospective study from June 2009 to October 2010 including 63 consecutive patients (32 men and 31 women) with a mean age of 55 years (range: 25–88) diagnosed with melanoma who were candidates for undergoing SLNB. A total of 66 melanomas were analyzed since three patients presented two synchronous melanomas. Five melanomas were of the head and neck, 28 of the trunk, 16 in the upper extremities and 17 in the lower extremities. Based on the histological type the distribution was as follows: 26 melanomas of superficial extension (39.4%), 19 nodular melanomas (28.8%), six acral lentiginous melanomas (9.1%), one case of lentigo maligna melanoma (1.5%), and in 14 cases variants of very low frequency were found or the histological type could not be determined (21.2%). The characteristics of the patients are presented in Table 1.

The indications for performing SLNB were:

- Melanomas diagnosed by excisional biopsy with a Breslow index >1 mm.
- Melanomas with a Breslow index <1 mm with:
  - Ulceration.
  - Clark levels IV and V.
  - Data of regression.
  - Superficial scraping.
  - Discordance between clinical impression and histological Breslow index.
  - Clinically negative lymph nodes.

Table 1
Characteristics of the patients and the melanomas.

Mean age (range)	55 (25–88)
Gender	No. (%)
Men	32 (51)
Women	31 (49)
Localization	
Head and neck	5 (8)
Trunk	28 (42)
Upper extremity	16 (24)
Lower extremity	17 (26)
Histological type	
Melanoma with superficial extension	26 (39.4)
Nodular melanoma	19 (28.8)
Acral lentiginous melanoma	6 (9.1)
Lentigo maligna melanoma	1 (1.5)
Others	14 (21.2)

Injection of the radiotracer

All patients were injected with a dose of 74 MBq of human albumin nanocolloid labeled with ^{99m}Tc (Nanocoll®, Gipharma, Italy), with a particle size of between 5 and 80 nm, in four syringes (0.2 ml in each syringe). The injections were performed around the primary lesion or pericicatricial (in the case of previous excisional biospy) at the positions of 0°, 90°, 180° and 270° with respect to the center of the lesion.

Preoperative lymphoscintigraphy

Following the injection of the radiotracer dynamic and static planar images were acquired from the injection site in anterior and posterior projection, adding other projections if considered necessary. At 2 h post-injection, a whole body image at 15 cm/min, planar images and SPECT/CT of the region of interest were acquired. The equipment used was a Symbia-T6 dual-head hybrid gamma camera (Siemens, USA), with a low energy, high resolution collimator. The planar images were acquired during 120 s, using a matrix of 256 × 256 and a zoom of 1.0. For the tomographic study a matrix of 128 × 128 was used, with a zoom of 1.0, and 32 images of 20 s were acquired. The CT was acquired with a matrix of 128 × 128, a zoom of 1.0, energy of 50 mA, 110 kV and a slice size of 1 mm. The reconstruction was carried out with filtered back projection applying a Butterworth filter (slice 0.5; order 5) and with a pixel size of 4.8 mm × 4.8 mm.

Interpretation of the images

The images were interpreted by 2 nuclear physicians with experience in the technique. The planar images of the lymphoscintigraphy were compared with those of the SPECT/CT. The number and localization of lymph nodes detected by the SPECT/CT were compared with that of the planar images, an assessment as to whether the SPECT/CT provided additional information was made.

Intraoperative detection

Intraoperative localization of the SLN was carried out 24 h after the injection of the radiotracer. To determine the precise site of the surgical incision the mark made on the skin and the gamma detection probe (Europrobe®, Eurorad, France) were used as a guide,