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● *Clinical Note*

THE TAIL AND THE STRING SIGN: NEW SONOGRAPHIC FEATURES OF SUBCUTANEOUS MELANOMA METASTASIS

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Abstract—No highly specific sonographic imaging findings to evaluate melanoma spread along the lymphatic vessels have ever been described. Between January 2009 and December 2012, a consecutive group of 531 melanoma patients at their initial stage or during follow-up for nodal or extra-nodal superficial metastasis were evaluated retrospectively to assess the presence of two sonographic findings demonstrating superficial lymphatic metastasis: a "tail" sign (a thin hypoechoic prolongation from one or both poles of a superficial metastasis) and a "string" sign (multiple in-transit lesions connected to each other in a rosary image). The total number of superficial metastatic lesions was 222. The tail sign was seen in 13 of the 222 lesions (5.9%). The string sign was detected in four patients (4.5%). These signs showed a low sensitivity with a very high specificity (100%). Tail and string signs may represent an additional finding of high specificity to be employed in the differential diagnosis of melanoma patients. (E-mail: an.cor@hotmail.it) © **2016 World Federation for Ultrasound in Medicine & Biology.**

Key Words: **Melanoma, High-resolution ultrasound, Metastasis, Lymph node metastasis, Subcutaneous tissue.**

INTRODUCTION

Melanoma cells spread along the lymphatic ducts, from the primary cutaneous lesion toward the lymph node station, draining that area (Dasgupta and Brasfield 1964). Lymph node metastases develop in up to 70% of patients with metastatic melanoma, while in the remaining 30% of cases, tumor cells spread *via* the bloodstream. The lymphatic diffusion is termed "satellitosis," when the lesion develops within 2 cm from the primary cutaneous tumor (or its scar, if the tumor has already been excised), and as in-transit metastasis, when the lesion grows at a greater distance (Fig. 1) (Tregnaghi et al. 1997). In the clinical history of many melanoma patients, there are multiple cutaneous or subcutaneous lesions developing along a lymphatic pathway. This is also demonstrated by the so-called interval node metastasis, which is located along the lymphatic course toward the regional lymph node stations, such as epitrochlear, popliteal and locoregional lymph nodes (Thompson et al. 2000).

High-resolution ultrasound (US) allows detection of very small melanoma deposits, with a high pathologic correlation (Catalano 2011). In this paper, we illustrate two new US findings recognizable in patients with superficial lymphatic metastasis from cutaneous melanoma. The "tail" sign consists of a thin hypoechoic prolongation from one or both poles of a superficial melanoma metastasis (Fig. 2). Sometimes these prolongations connect multiple in-transit lesions, becoming attached to each other in a rosary image we called the "string" sign (Fig. 3). We believe the tail and string signs are due to the lymphatic vessels filled of melanoma cells, representing a possible presentation of the lymphatic spread.

MATERIALS AND METHODS

Patients

From a radiology information system/picture archiving and communication system database, we assessed, by using a consensus assessment of two radiologists, the high-resolution US images of 531 consecutive melanoma patients examined between January 2009 and December 2012. These patients underwent sonographic examination in our radiology department at their

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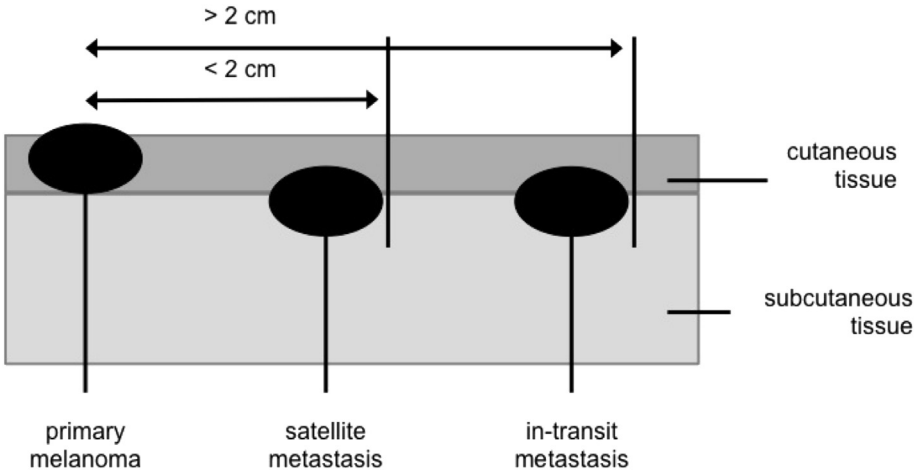

Fig. 1. Drawing of loco-regional spread of cutaneous melanoma. Melanoma metastasis is described as satellite metastasis when found within 2 cm from the primary tumor (or its scar) and as in-transit metastasis if the lesion is located at a greater distance.

initial stage or during follow-up for nodal or extra-nodal superficial metastasis. All patients were imaged once and those with lack of adequate US examination available were excluded. All patients with evidence of single or multiple suspected lesions at US examination had undergone free-hand fine-needle cytologic aspiration by US guidance to confirm their nature. Moreover, for every patient, two needle cytologies were carried out on average on each patient during a single setting. Patients' age ranged from 20–88 y, with a sex distribution of 208 males (39%) and 323 females (61%).

US examination

The 531 patients underwent a standardized US examination (Catalano et al. 2010), which included a tissue harmonic imaging mode and a power and color Doppler assessment performed with a MyLab 70 XVG and a MyLab 70 Twice scanner (Esaote, Genoa, Italy) equipped with high-resolution multi-frequency linear probes (up to 13 MHz). We used higher frequencies for superficial lesions and lower frequencies for deeper lesions, focusing the beam immediately below the area of interest. For very superficial lesions, we used a gel standoff pad to better focus the beam at the level of the lesion on B-mode scans and to detect intra-lesional flow signals on Doppler imaging. Adopting a trapezoidal field of view or acquiring a real-time extended field of view image were also used to display larger melanoma metastatic lesions and to measure the distance between multiple lesions or between a given lesion and an anatomic landmark such as primary melanoma, melanoma scar or vessels. Color and power Doppler imaging were employed to assess flow signals. We prefer using the power Doppler mode, which on our scanners is more sensitive to slow flow than the color Doppler mode. Power Doppler was set for detecting slow flows, with low pulse repetition frequency (750 Hz), high color gain (just below the noise threshold), high transmission frequency (6.3–7.1 MHz) and minimal filter. We first scanned the skin at the level of the primary tumor (or its scar), 10 cm all around, to rule out satellite metastases. Then, we moved the transducer along the presumable course of the lymphatic vessels, toward the regional lymph nodes, to detect in-transit metastases. We widely explored the lymphatic stations appropriate for each primary melanoma site. In trunk melanomas, we scanned not only the supra-clavicular and axillary nodes, but also the deep pectoral and infra-clavicular nodes. When the primary melanoma was in the head or neck, we explored the cervical stations but also the supra-clavicular stations bilaterally. In upper limb and upper trunk melanomas, we also included the supra-clavicular and infra-clavicular stations. When the primary

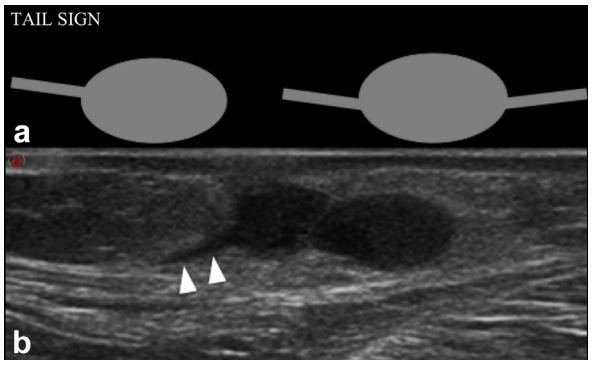

Fig. 2. (a) The drawing illustrates the tail sign, seen as a small prolongation seen on one or both poles of the nodule. (b) High-resolution ultrasound image shows a melanoma in-transit metastasis in the inguinal region with the tail sign at one pole of the nodule (arrowheads).