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ORIGINAL REPORT

Usefulness of the twinkling artifact on Doppler ultrasound for the detection of breast microcalcifications☆

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Abstract
Objective: To determine whether the twinkling artifact on Doppler ultrasound imaging corresponds to microcalcifications previously seen on mammograms and to evaluate the usefulness of this finding in the ultrasound management of suspicious microcalcifications.
Material and methods: We used ultrasonography to prospectively examine 46 consecutive patients with groups of microcalcifications suspicious for malignancy identified at mammography, searching for the presence of the twinkling artifact to identify the microcalcifications. Once we identified the microcalcifications, we obtained core-needle biopsy specimens with 11G needles and then used X-rays to check the specimens for the presence of microcalcifications. We analyzed the percentage of detection and obtainment of microcalcifications by core-needle biopsy with this technique and the radiopathologic correlation. Microcalcifications that were not detected by ultrasound or discordant lesions were biopsied by stereotaxy at another center. We also used ultrasound guidance for preoperative marking with clips, usually orienting them radially.
Results: We identified and biopsied 41 of the 46 lesions under ultrasound guidance, including 24 of 25 carcinomas (17 in situ). B-mode ultrasound was sufficient for biopsying the microcalcifications in 14 patients, although the presence of the twinkling artifact increased the number of microcalcifications detected and thus enabled more accurate preoperative marking. Thanks to the twinkling sign, we were able to identify 27 additional groups of microcalcifications (89% vs. 30%; $p < 0.05$). All the surgical specimens had margins free of disease.
Conclusions: The twinkling artifact is useful for microcalcifications in ultrasound examinations, enabling a significant increase in the yield of ultrasound-guided biopsies and better preoperative marking of groups of microcalcifications.

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PALABRAS CLAVE
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Microcalcificaciones

Utilidad del artefacto Doppler de centelleo de color (*twinkle*) en la detección ecográfica de microcalcificaciones mamarias

Resumen
Objetivo: Verificar si el artefacto de *twinkle* (AT) se corresponde con la presencia de microcalcificaciones previamente vistas mediante mamografía, y valorar su utilidad en el manejo ecográfico de microcalcificaciones sospechosas.
Material y métodos: Hemos examinado prospectivamente mediante ecografía a 46 pacientes consecutivas con grupos de microcalcificaciones sospechosos de malignidad, sin otros hallazgos mamográficos de sospecha, buscando la presencia del AT para identificar las microcalcificaciones. Cuando lo conseguimos, procedimos a biopsiarlas con aguja gruesa (BAG) 11G, y posteriormente comprobamos la presencia de las microcalcificaciones mediante radiografía de las muestras obtenidas. Analizamos el porcentaje de detección y obtención de microcalcificaciones con la BAG, usando esta técnica, así como la concordancia radiopatológica. Las microcalcificaciones no detectadas con ecografía, o no concordantes, fueron biopsiadas mediante estereotaxia en otro centro. También utilizamos guía ecográfica para el marcaje preoperatorio con arpones, orientándolos habitualmente de forma radial.
Resultados: Se identificaron y biopsiaron con ecografía 41 de las 46 lesiones, incluyendo 24 de los 25 carcinomas (17 de ellos in situ). La ecografía en modo B bastó para biopsiar las microcalcificaciones en 14 pacientes, aunque en 6 de ellas el AT incrementó el número de microcalcificaciones detectadas, lo que permitió un marcaje preoperatorio más preciso. Gracias al AT identificamos 27 grupos adicionales (89% vs. 30%; $p < 0{,}05$). Todas las piezas quirúrgicas mostraron bordes libres.
Conclusiones: El AT es una herramienta útil para la identificación ecográfica de microcalcificaciones, lo que permite un significativo incremento de las biopsias guiadas por ecografía, así como una mejor delimitación preoperatoria.

Introduction

Microcalcification clusters can be the only mammogram-detected manifestation of breast cancer in early stages. Their identification is crucial for early diagnosis, since up to 90% of in situ ductal carcinomas identified by the mammograms show microcalcifications.[1] Mammograms play an essential role in their detection and characterization. It is necessary to biopsy those groups classified as suspicious groups, in order to analyze them histologically.

The routine management of breast microcalcifications is stereotaxis-guided vacuum-assisted biopsy (VAB).[2] Nevertheless, many centers, such as ours, have no stereotaxis machines available. Also, between 2 and 13% of all microcalcifications cannot be biopsied by this technique, either because of their poor visualization, or because they are in extremely thin breasts, of groups that are next to the thoracic wall or the armpit, or due to the patient's inability to maintain the prone decubitus position.[3] In general, ultrasound-guided interventional procedures are tolerated better, they do not compress the breast or use radiation,[4] and they are available at all the centers. That is why ultrasound guidance is preferred in interventional procedures when the lesion can be identified through such method. It is precisely the poor visibility of breast microcalcifications through ultrasound that has conditioned its scarce role in their management.[5]

The twinkling artifact (TA), also known as color comet-tail artifact, is a phenomenon that can be translated as the presence of random colors that simulate flow; they change rapidly and appear behind certain highly reflective stationary objects, when studied using the color Doppler technique. It was first described by Rahmouni[6] in the context of urolithiasis. The factors involved in the genesis and appearance of TA have not been determined yet, despite the many studies conducted in vitro so far trying to understand this phenomenon and increase its utility as a diagnostic tool. It seems that the presence of irregular surfaces favors their appearance. As examples of matters that generate TA we include, in addition to calculi, tissue calcifications, fibrosis and foreign bodies such as surgical clips, catheters and harpoons.[7–13] The TA can be useful when we are looking for highly reflective, small objects, especially when they are located in the context of hyperechogenic tissues, such as it is the case with the small calculi found inside the renal sinus or the breast fibroglandular tissue. Unlike the TA, the actual flow shows a pulsatile signal, measurable through the pulsated Doppler mode and identifiable along the trajectory of a vessel (video 1).

However, and unlike urologic ultrasound scans, there is little literature on the utility of the TA for the detection of microcalcifications found on the mammogram. One single case has been published in which the TA facilitated the biopsy of a group of microcalcifications.[10] The goal of this study was to verify whether the TA is able to identify