P201

ULTRA-HIGH FREQUENCY ULTRASOUND AND MACHINE LEARNING APPROACHES FOR THE DIFFERENTIAL DIAGNOSIS OF MELANOCYTIC LESIONS

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Background: Malignant melanoma (MM) is one of the most dangerous skin cancers and early MM detection improves prognosis and survival rates[1,2]. Differentiating between MM and atypical melanocytic nevi (MN) can often be difficult, therefore additional non-invasive methods could assist with diagnostic accuracy. The ultra-high frequency ultrasound has been recently described as a new promising tool for early diagnosis and management of MM[3,4]. The aim of this study was to present a potential new method for the differential diagnosis of MM from melanocytic naevi (MN).

Methods: We examined 20 MM and 19 MN with a new ultra-high frequency ultrasound (UHFUS; VevoMD, Fujifilm, Visualsonics, Toronto, Canada), equipped with 3 different probes (22,48,70 MHz), providing a spatial resolution up to 30 microns. The study population consisted of 20 caucasian patients with MM (7 women and 13 men), aged from 26 to 84 years (mean age 56.8) and 19 caucasian patients with MN (12 women and 7 men), aged from 15 and 60 years (mean age 37.6). We acquired the ultrasonographic images using the 70 MHz probe and images were processed for calculating 8 morphological parameters (area, perimeter, circularity, area ratio, standard deviation of normalized radial range, roughness index, overlap ratio and normalized residual mean square value) and 122 texture parameters. Colour Doppler images were used to evaluate the vascularization. Features reduction was implemented by means of principal component analysis (PCA), and 23 classification algorithms were tested on the reduced features using histological response as ground-truth[5].

Results: MN and MM appeared as hypoechoic fusiform (84% of MN; 95% of MM) or oval-shaped (16% of MN, 5% of MM) inhomogeneous lesions (Fig.1a-b), with a variable degree of intralesional vascularization (Fig.2a-c) most frequently found in MM instead of MN (85% of MM; 26% of MN) (Fig.3a-d). Best results were obtained using only the first component of the PCA and the weighted k-nearest neighbour classifier; this combination led to an accuracy of 76.9%, area under the ROC curve of 83%, sensitivity of 84% and specificity of 70 (Fig.4)[5].

Conclusions: Our best classifier performed very well in terms of accuracy and AUC of the ROC curve. The histological analysis still remains the gold-standard, but the UHFUS images processing using a machine learning approach could represent a new non-invasive approach to differential diagnosis of melanocytic lesions.

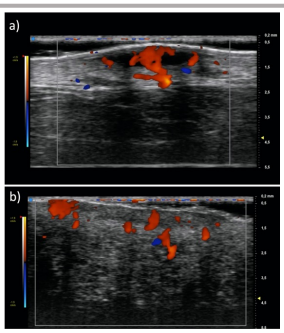

Figure 1. UHFUS shows intralesional and sublesional hypervascularity (1.9 cm/sec) of a fusiform (a) and an oval-shaped (b) melanomas.

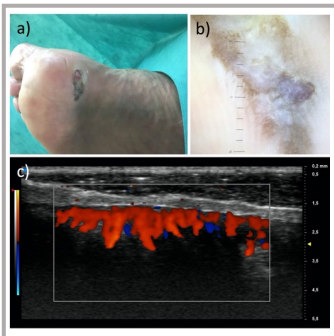

Figure 2. Clinical (a) and dermoscopic features (b) of an acral lentiginous melanoma. The color Doppler evaluation with UHFUS (1.9 cm/sec) shows hypervascularity of the lesion (c).

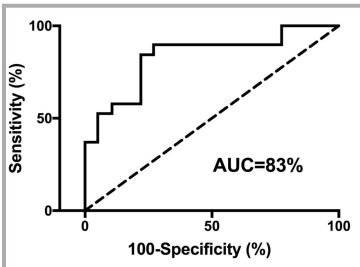

Figure 4. ROC analysis of the differential diagnosis between melanoma and melanocytic nevus. The curve depicts classification results obtained by the weighted k-nearest neighbor classifier which scored the best accuracy (76.9%) between all tested classifiers.

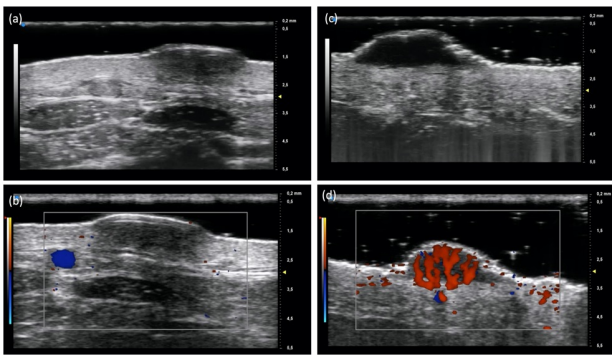

Figure 3. Examples of B-mode and colour Doppler images obtained for a melanocytic naevus (a, b) and a malignant melanoma (c, d), respectively. The melanocytic naevus appears as an oval inhomogeneous non-vascularized hypoechoic lesion (a,b); instead, the melanoma appears as a fusiform vascularized inhomogeneous hypoechoic lesion (c,d).

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