Diagnostic accuracy of dermatoscopy for melanocytic and nonmelanocytic pigmented lesions

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Background: It is unknown whether dermatoscopy improves the diagnostic accuracy for all types of pigmented skin lesions or only for those that are melanocytic.

Objective: We sought to assess if the addition of dermatoscopy to clinical examination with the unaided eye improves diagnostic accuracy for all types of pigmented lesions.

Methods: We analyzed 463 consecutively excised pigmented skin lesions collected during a period of 30 months in a primary care skin cancer practice in Queensland, Australia.

Results: Of 463 lesions, 217 (46.9%) were nonmelanocytic. Overall 30% (n = 138) were malignant including 29 melanomas, 72 basal cell carcinomas, and 37 squamous cell carcinomas. The diagnostic accuracy for malignant neoplasms measured as area under receiver operating characteristic curves was 0.89 with dermatoscopy and 0.83 without it ($P < .001$). Given a fixed specificity of 80%, the corresponding sensitivity was 82.6% with dermatoscopy and 70.5% without it. The improvement achieved by dermatoscopy was higher for nonmelanocytic lesions than for melanocytic lesions. A short algorithm based on pattern analysis reached a sensitivity of 98.6% for basal cell carcinoma, 86.5% for pigmented squamous cell carcinoma, and 79.3% for melanoma. Among benign conditions, the highest false-positive rate (90.5%) was observed for lichen planus–like keratosis.

Limitations: Estimates of diagnostic accuracy are influenced by verification bias.

Conclusions: Dermatoscopy improves the diagnostic accuracy for nonmelanocytic lesions. A simple algorithm based on pattern analysis is suitable for the detection of melanoma and nonmelanoma skin cancer. (J Am Acad Dermatol 2011;64:1068-73.)

Key words: basal cell carcinoma; dermatoscopy; melanocytic nevi; melanoma; nonmelanoma skin cancer; pigmented skin lesions; squamous cell carcinoma.

A battery of studies including 3 meta-analyses demonstrates that dermatoscopy improves the diagnostic accuracy for pigmented skin lesions in comparison with examination with the unaided eye.[1-3] However, all studies focused on the differentiation between melanoma and melanocytic nevi, without adequately considering the fact that many pigmented lesions examined in routine clinical practice are not of melanocytic origin. Nonmelanocytic pigmented lesions frequently examined by dermatoscopy are seborrheic keratoses, solar lentigines, lichen planus–like keratoses (LPLK) (also known as benign lichenoid keratoses), dermatofibromas, basal cell carcinomas (BCC), pigmented Bowen disease, pigmented actinic keratoses, and pigmented inflammatory conditions.[4-14] It is still

Abbreviations used:

AUC:	area under the receiver operating characteristic curve
BCC:	basal cell carcinoma
FPR:	false-positive rate
LPLK:	lichen planus–like keratoses

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unknown as to whether dermatoscopy also improves the diagnostic accuracy for these lesions.

The primary aims of this study were to: (1) determine the proportions of equivocal melanocytic and nonmelanocytic lesions in an area with high incidence of both melanoma and nonmelanoma skin cancer, using a consecutive series comprising all pigmented skin lesions submitted for histology; and (2) analyze whether the diagnostic accuracy for all pigmented malignant neoplasms increases if dermatoscopy is used in addition to inspection with the unaided eye.

CAPSULE SUMMARY

- It is unknown whether dermatoscopy improves the diagnostic accuracy for all types of pigmented skin lesions or only for those that are melanocytic.
- In this series of 463 cases including 217 (46.9%) nonmelanocytic lesions we show that the addition of dermatoscopy to clinical examination particularly improves the diagnostic accuracy for nonmelanocytic pigmented lesions.
- A simple algorithm based on pattern analysis is suitable for the detection of melanoma and nonmelanoma skin cancer.

METHODS

The cases collected were from a consecutive series of lesions submitted for histology from the primary care skin cancer practice of author C. R. As all lesions scheduled for biopsy in this practice are routinely photographed, clinical and dermatoscopy images were available for all lesions. Clinical images (overview and close-up) were taken with Canon EOS digital single lens reflex (SLR) cameras (Canon, Tokyo, Japan). The close-up was taken using a macro lens (60-mm *f*2.8 macro, Canon) with diffuse illumination at a constant reproduction ratio determined by a custom-fabricated spacer. The degree of magnification of the close-up images was similar to that of the dermatoscopy images.

Dermatoscopic images were nonpolarizing, preferentially using the Dermlite Fluid device (3 Gen, San Juan Capistrano, CA); alternatively Dermlite Foto (custom nonpolarized) (3 Gen) and Heine Delta 20 devices (Heine, Optotechnic GmbH, Herrsching, Germany) were used for large and inaccessible lesions, respectively. Dermatoscopic photographs were taken with Canon EOS SLR cameras (Canon). Images were presented to the assessors as PowerPoint slides (Microsoft Corporation, Redmond, WA).

During the 30-month collection period, 1959 lesions were biopsied or excised and 24% (n = 466) of these were pigmented. Three were excluded from the study because of poor image quality leaving 463 suitable for study. The study was approved by the local ethics committee of the University of Queensland, Australia.

Histopathologic diagnosis and classification of cases

All lesions were excised or biopsied and subjected to standard histopathologic examination. Histopathology was regarded as the diagnostic gold standard. If the histopathologic diagnosis was not in line with the clinical or dermatoscopic diagnosis, the pathologist was asked to re-examine the specimen. Although additional deeper cuts were requested on several specimens, this did not result in any changes of diagnosis.

We categorized the cases into benign and malignant lesions. The malignant group included melanomas, BCC, and squamous cell carcinomas. All other lesions were benign. We classified actinic keratoses (n = 14) as a superficial variant of cutaneous squamous cell carcinoma, and thus malignant. Melanocytic nevi and melanomas were classified as melanocytic; all other lesions were classified as nonmelanocytic.

Presentation of images and rating

For each lesion a triplet of high-resolution digital images, a pair of clinical images (overview and close-up), followed by a dermatoscopic image was presented to a blinded observer on a computer screen. After viewing the clinical images the observer had to give a diagnosis (only one diagnosis was allowed) and was asked to indicate the level of confidence that the lesion presented was benign or malignant. The level of confidence was recorded on a continuous rating scale ranging from 0 (absolute certainty that the lesion is benign) to 100 (absolute certainty that the lesion is malignant). This procedure was repeated after presentation of the dermatoscopic image. Dermatoscopic images were also screened for asymmetry of structure and color (“chaos”) and for clues to malignancy. Asymmetry of structure and color were defined according to the basic principles of pattern analysis as revised by Kittler.[15] Clues to malignancy included: eccentric structureless zone (any color except skin color), gray or blue structures, peripheral black dots or clods, segmental radial lines or pseudopods, polymorphous vessels, white lines, thick reticular or branched lines, and parallel lines on ridges (acral lesions).

Statistical analysis

Continuous variables are given as mean and SD. We calculated true-positive rates (sensitivity), false-positive rates (FPR), and true-negative rates