In vivo epiluminescence microscopy of pigmented skin lesions. I. Pattern analysis of pigmented skin lesions

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The importance of recognizing early melanoma is generally accepted. Because not all pigmented skin lesions can be diagnosed correctly by their clinical appearance, additional criteria are required for the clinical diagnosis of such lesions. In vivo epiluminescence microscopy provides for a more detailed inspection of the surface of pigmented skin lesions, and, by using the oil immersion technic, which renders the epidermis translucent, opens a new dimension of skin morphology by including the dermoepidermal junction into the macroscopic evaluation of a lesion. In an epiluminescence microscopy study of more than 3000 pigmented skin lesions we have defined morphologic criteria that are not readily apparent to the naked eye but that are detected easily by epiluminescence microscopy and represent relatively reliable markers of benign and malignant pigmented skin lesions. These features include specific patterns, colors, and intensities of pigmentation, as well as the configuration, regularity, and other characteristics of both the margin and the surface of pigmented skin lesions. Pattern analysis of these features permits a distinction between different types of pigmented skin lesions and, in particular, between benign and malignant growth patterns. Epiluminescence microscopy is thus a valuable addition to the diagnostic armamentarium of pigmented skin lesions at a clinical level. (J AM ACAD DERMATOL 1987; 17:571-83.)

The curability of cutaneous malignant melanoma by surgical excision in early stages of tumor development is well established and emphasizes the necessity for early tumor recognition.1-3 Because not all pigmented skin lesions can be diagnosed correctly by clinical appearance alone even by experienced dermatologists, additional criteria are required for their clinical diagnosis. This appears particularly important for small pigmented skin lesions that clinically have not yet developed those criteria currently used in distinguishing benign from malignant lesions.

In 1971 MacKie4 initiated attempts to increase the resolution of the eye in clinical diagnosis by utilizing epiluminescence microscopy, following up on an earlier study of Goldman,5 who had employed in vivo microscopy in diagnosing pigmented nevi. Epiluminescence microscopy permits not only the examination of surface details of lesions but also, by employing the oil immersion technic that renders the epidermis translucent, it permits study of the dermoepidermal junction.6

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Surprisingly little attention has been paid to this approach, also utilized by Cunliffe et al, until Fritsch and Pechlaner improved the technic and emphasized its potential importance in the differentiation of benign from malignant melanocytic skin lesions. In the present paper we report our experience with epiluminescence microscopy in a study of more than 3000 pigmented skin lesions over a period of 4 years and describe the criteria we have found helpful in distinguishing benign from malignant pigmented skin lesions.

MATERIALS AND METHODS

Epiluminescence microscopy was performed using a WILD M650 (Wild Heerbrugg AG, Heerbrugg, Switzerland) binocular surface microscope equipped with objectives of 91 mm working distance (Fig. 1). Magnifications obtainable with this microscope are ×6, ×10, ×16, ×25, and ×40. Patients are examined in supine position with the microscope adjusted over the lesion. Over a period of 4 years more than 3000 pigmented skin lesions were studied. All pigmented skin lesions were first examined for their surface structure. They were then covered with immersion oil and a glass slide that was applied with slight pressure; this renders the epidermis translucent and allows study of the dermoepidermal junction zone. Photographs of the pigmented skin lesions were taken simultaneously with an Olympus CM10 automatic camera, mounted on a side arm of the microscope. The advantage of this arrangement is that pigmented skin lesions can be visually monitored during photography.

All pigmented skin lesions involved in the study were excised after epiluminescence microscopy examination and were subjected to histopathologic examination, usually employing serial sections. Histopathology was performed to verify the epiluminescence microscopy diagnosis and to correlate features found by epiluminescence microscopy with their histopathologic substrate.

RESULTS

Pattern analysis

Criteria were established that permit the distinction of benign from malignant growth patterns. These criteria are based on:

1. The general appearance of pigmented skin lesions, which may be uniform or heterogeneous, the profile of the pigmented skin lesions, which may appear within the level of the surrounding skin, elevated or depressed, and the surface, which may correspond to that of the surrounding skin or may be smooth or rough

2. The pattern of pigmentation, including color, intensity, depigmentation, and particular pigment patterns, such as the so-called pigment network, brown globules, and black dots, which will be defined later

3. The margin of pigmented skin lesions, which may be regular or irregular, the latter sometimes characterized by specific pigment patterns that we have termed pseudopods and radial streaming

Pattern analysis of normal skin. When viewed with epiluminescence microscopy without immersion oil, normal skin displays a pattern of roughly
rhomboid or square fields outlined by intersecting grooves. Depending on the region investigated, the structure and profile of the skin surface may vary considerably.  

With oil epiluminescence microscopy, the epidermis becomes translucent and discloses a network of subtle beige, faint lines corresponding to the skin grooves. With higher magnifications, capillaries are seen as red dots or tiny lines.

The pattern and intensity of pigmentation depend on race, body region investigated, and degree of tanning. Normal white skin and body regions that are not exposed to sunlight display a homogeneous, faint, brown background tan with a discrete regular network of pigmented lines. In more pigmented or heavily tanned skin, the background tan becomes more intense and patchy and a faint pigment network (see below) emerges.

Pattern analysis of pigmented skin lesions

Type of color. With epiluminescence microscopy most pigmented skin lesions appear more or less uniformly brown to black except for areas of hypopigmentation. When the oil immersion technique is used this uniformity is in part replaced by a more subtle picture of uniformly and non-uniformly pigmented areas, and of different colors and patterns of color distribution (compare Figs. 2-9). Depending on the localization of the melanin pigment within the skin, the color may vary. Changes of melanin pigment localized in the uppermost parts of the epidermis, that is, the cornified layers, appear black. Pigmentation of lower epidermal cell layers appears brown, either as subtle lines forming the pigment network (see below) or as brown globules, the latter corresponding to nests of melanin containing melanocytes in the lower epidermis (see below). Pigment in the papillary dermis appears gray, whereas pigmentation of the reticular dermis is steel blue. These types of pigmentation may be uniform, obscuring any other structures, or may reveal a system of differentiated pigment patterns.

Pigment patterns

Pigment network: At higher magnifications, oil epiluminescence microscopy discloses a subtle network of brownish lines over the background tan, the so-called pigment network (Figs. 10-12).

The anatomic basis of the pigment network is melanin pigment in the cells of the epidermal basal cell layers. The holes observed in the network correspond to the tips of the dermal papillae and the network itself to the projection of the pigmented rete ridges to the skin surface. The appearance of the pigment network is thus determined by size and configuration of the rete ridges. An irregular pigment network reflects coarse, haphazardly spaced rete ridges. Its appearance depends on the degree of pigmentation of the pigmented skin lesions and it may be prominent or discrete.

In benign pigmented skin lesions the pigment network shows a relatively regular pattern with circular or oval meshes (Figs. 10 and 12), and it may be crisp (Fig. 12) or blurred (Fig. 10, b); an irregular pigment network with variable mesh size and configuration (Fig. 11, a) may indicate dysplasia or malignancy.

Brown globules: Nests of melanin containing melanocytes in the lower epidermis appear as brown globules (Figs. 13 and 14), as verified by a correlation of the epiluminescence microscopy appearance and histopathology of a given lesion. These may be uniform in size and regular as in benign pigmented skin lesions (Fig. 13, a) and may be of different size and haphazardly spaced, as in dysplastic or (early) malignant pigmented skin lesions (Fig. 14, a, c).

Black dots: Black dots represent focal accumulations of melanin in the cornified layers of the epidermis. In benign pigmented skin lesions, when visible, they occur only in the center; in malignant or dysplastic pigmented skin lesions they may also occur in the periphery of the lesion (Figs. 11, c and 15, b).

Relationship of uniform pigmentation and other pigment patterns: The distribution of pigment patterns within a given lesion may be regular or irregular. Only rarely are pigmented skin lesions uniformly black or brown when viewed with oil immersion.

In benign pigmented skin lesions the uniform pigmentation is regular and located in the center of the lesion (Fig. 10, a) from where it gradually thins out toward the periphery where other pigment
patterns, such as brown globules and the pigment network, appear (Fig. 10, b). In malignant pigmented skin lesions the uniformly pigmented areas are irregular, haphazardly distributed, and may involve the periphery of the lesion (Fig. 15).

Depigmentation: Depigmentations represent absence of pigment and/or areas of regression. The term depigmentation, as used here, is always relative to the overall brown or black color of the lesion. In benign pigmented skin lesions depigmentation is regular and found in the center of the lesions (Fig. 7, b) and in malignant pigmented skin lesions it is irregular and anywhere in the lesion (Fig. 9, b).

Margin of pigmented skin lesions. Basically the margin of pigmented skin lesions may be regular

Figs. 2-9. For legends, see opposite page.
or irregular. Regular margins may have either a well-defined pigment border (Fig. 7) or may reveal a thinning out of the pigment network into the surrounding normal skin, as is most often the case in benign pigmented skin lesions (Fig. 10, b). By contrast, in malignant pigmented skin lesions the border of pigmentation is always irregular, revealing two types of configurational features: (1) pseudopods are irregular, relatively broad and blunt, occasionally ramified extensions of the heavily pigmented margin of the lesion into surrounding skin (Fig. 16, a); (2) radial streaming describes relatively regular, finely serrate extensions radiating from the pigmented skin lesions (Figs. 3, c and 15, a). Both correspond to the radial growth phase of melanoma. In general, the pigment network stops abruptly at the edge of a malignant pigmented skin lesion (Fig. 3, d), whereas it thins out in benign pigmented skin lesion (Figs. 10, b and 12).

Pattern analysis of benign and malignant pigmented skin lesions

**Junctional nevi:** Junctional nevi are first seen as orderly, well-defined lesions with uniform appearance, but they occasionally may have an irregular outline (Figs. 4 and 5). The skin surface is usually smooth or retains the surface structure of the surrounding skin, and the lesions are usually within the level of the surrounding skin or are slightly elevated. Junctional nevi exhibit a uniform background pigmentation (center) (Figs. 10, a) and the pigment network in the periphery. The pigment network is regular, discrete, and often blurred and thins out into the normal skin (Fig. 10, b). In the center of the less pigmented lesions black dots may occur, surrounded by multiple brown globules of uniform size that are regularly spaced and are usually threaded along the meshes of the pigment network. Occasionally the pigment network may be very prominent or may

Figs. 2-9. These four lesions (Figs. 2, 4, 6, and 8) all look similar clinically and are shown to demonstrate the value of pattern analysis in distinguishing benign from malignant pigmented skin lesions. Each lesion is shown without (left panel; Figs. 2, 4, 6, and 8) and with oil immersion (right panel; Figs. 3, 5, 7, and 9).

Figs. 2 and 3. Acrolentiginous melanoma, palm. *Fig. 2.,* The lesion is irregular in outline, the surface texture differs from that of the surrounding skin, there is brown, black, and blue. Oil immersion (*Fig. 3.*) reveals a prominent and sharply defined pigment network (a), black dots at the periphery of the lesion (b), and radial streaming (c). Criteria indicating that this lesion is malignant are the combined presence of irregularity, black dots at the periphery (b), abrupt peripheral stop of the prominent pigment network (d), and radial streaming (c). (*x 10.)*

Figs. 4 and 5. Small junctional nevus, sole. *Fig. 4.* This lesion is also irregular (a), the surface structure differs from that of the surrounding skin, there is black and brown. However, criteria indicating that the lesion is nonetheless benign are revealed by oil immersion (*Fig. 5.*) and include the blurred pigment network (a) and the absence of black dots and radial streaming (compare with Figs. 2 and 3). (*x 10.)*

Figs. 6 and 7. Pigmented Spitz nevus. *Fig. 6.* The lesion appears relatively regular, the normal surface pattern of skin is obliterated, and there is brown, black, and blue. Oil immersion (*Fig. 7.*) shows that this is a pigmented Spitz nevus and not melanoma: pronounced and heavily pigmented, regular network with meshes that consist only of thin lines and dots (a); in the center the network appears depigmented, white, and bizarre (b); the margin is well defined and regular without pseudopods or radial streaming. (*x 10.)*

Figs. 8 and 9. Small superficial spreading melanoma with a central nodular component. *Fig. 8.* There is brown, black, and blue and the outlines are irregular, which is particularly evident with oil immersion (*Fig. 9.*) The pigment network is irregular (a), and depigmentation is also irregular; it is found both in the center and close to the periphery (b) and reveals both white and blue. The black areas are highly irregular, and black dots, which are bizarre and of unequal size, are found both in the center and at the periphery (c). (*Fig. 8, x10; Fig. 9, x16.*)
Figs. 10-18. Examples of characteristic pigment patterns employed as diagnostic criteria in pattern analysis of pigmented skin lesions. These patterns become visible only with oil immersion.

Fig. 10. Pigment network. The photograph shows a lesion with a uniform hyperpigmentation in the center (a) and, more peripherally, a pigment network that appears regular but blurred and gradually thins out at the margin (b). This is the typical appearance of a junctional nevus. (×16.)

Fig. 11. Pigment network. Here it is prominent and highly irregular, with unequal mesh size (a) and streaky configurations (b). Black dots are unevenly distributed (c). This is a dysplastic nevus (type I, junctional type). (×16.)

Legends continued on opposite page.
be overshadowed by the uniform background pigmentation, which may be heavy enough to obscure it completely. Depigmentation does not occur. The margins of the lesions, have no radial streaming or pseudopods (Figs. 5 and 10).

**Dermal nevi:** Dermal nevi have no particular characteristic features when viewed by epiluminescence microscopy. They have no pigment network, brown globules, or black dots, and they appear as skin-colored nodules without any pigmentation or as brown, papillomatous skin lesions. Sometimes capillaries are seen as red dots or tiny lines. The border of dermal nevi is usually well defined and regular.

**Compound nevi:** Compound nevi have a papular component but usually are orderly and uniform and exhibit features of both dermal and junctional nevi. The pigment network, although not a prominent feature, is regular and thins out at the periphery. Nests of epidermal melanocytes appearing as brown globules are usually distributed regularly throughout the lesions (Fig. 13, a). They may coalesce to uniform brown areas that are ill defined but of regular configuration (Fig. 13, b). The center of the lesion may be uniformly and heavily pigmented or may reveal few black dots. The margin is regular as in junctional nevi.

**Pigmented Spitz nevi:** Pigmented Spitz nevi are highly regular round, monomorphous, and uniform papules. They exhibit a prominent and a regular pigment network that stops abruptly at the well-defined border of the lesions (Fig. 7, a); it may be so heavily pigmented and the rete ridges may be so wide that the meshes of the network (i.e., the dermal papillae) show up only as fine, crisp, hypopigmented lines and dots (Fig. 7, a).
Table I. Pattern analysis of pigmented skin lesions by epiluminescence microscopy

<table>
<thead>
<tr>
<th>Type of lesion</th>
<th>Junctional nevus</th>
<th>Compound nevus</th>
<th>Dermal nevus</th>
</tr>
</thead>
<tbody>
<tr>
<td>General appearance</td>
<td>Orderly; uniform</td>
<td>Orderly</td>
<td>Orderly</td>
</tr>
<tr>
<td>Surface</td>
<td>Skin surface preserved or smooth; no scales</td>
<td>Skin surface coarse; hyperkeratotic, smooth</td>
<td>Skin surface not preserved; papillomatous to smooth</td>
</tr>
<tr>
<td>Pigment pattern</td>
<td>Regular pigment network at periphery that is usually blurred; brown globules of equal size threaded along meshes of pigment network, regularly spaced; in the center pigment network is overshadowed by intense uniform pigmentation; black dots may occur in center of lesion</td>
<td>Regular pigment network, blurred; brown globules of equal size threaded along meshes of pigment network, regularly spaced; in the center pigment network is overshadowed by intense uniform pigmentation; black dots may occur in center of lesion</td>
<td>No pigment network; no brown globules or black dots</td>
</tr>
<tr>
<td>Border</td>
<td>Regular; simple outline, pigment network thins out at periphery; no pseudopods; no radial streaming</td>
<td>Regular; simple outline, pigment network thins out at periphery; no pseudopods; no radial streaming</td>
<td>Regular; simple outline</td>
</tr>
<tr>
<td>Depigmentation (hypopigmentation)</td>
<td>Usually absent</td>
<td>Regular; well defined</td>
<td>Infrequent</td>
</tr>
</tbody>
</table>

*Amelanotic nodular melanoma lacks pigment, appears as skin-colored nodule but may exhibit the features of pigmented nodular melanoma at the border.

Brown globules of different sizes may be present throughout the lesions. Black dots may be found in the center. A characteristic finding of Spitz nevi is a regular but bizarre, retiform depigmentation in the center (Fig. 7, b). The margin of the lesion is well defined and regular without pseudopods or radial streaming (Fig. 7).

**Blue nevi:** Blue nevi appear as relatively regular, uniform, and monomorphic, slightly elevated papules. The skin surface is usually preserved or is smooth. When viewed under oil epiluminescence microscopy, blue nevi exhibit a homogeneous blue-gray color at all levels of focus, with a complete absence of pigment pattern formations such as pigment network, brown globules, or black dots (Fig. 17). The border of the lesions is relatively well defined: pseudopods and radial streaming are absent.

**Dysplastic nevi:** By epiluminescence microscopy two types of dysplastic nevi can be differentiated. One is a flat and brownish dysplastic nevus, which we have designated dysplastic nevus type I. This lesion is a predominantly junctional dysplastic nevus. The second type of dysplastic nevus, type II (epidermal-dermal), is reddish or pink and has both a macular and a papular component. The usually eccentrically located papule represents dermal nevus cells and is often surrounded by a macular collar.

A prominent pigment network is found only in type I dysplastic nevus. It is usually highly irregular (Fig. 11, a and b) and may focally stop abruptly at the margin. Brown globules of different sizes and haphazardly spaced may be observed and black dots are usually present. At some sites, the pigment network or the brown globules are over-
### Type of lesion

<table>
<thead>
<tr>
<th>Pigmented Spitz nevus</th>
<th>Blue nevus</th>
<th>Lentigo simplex and nevoid lentigo</th>
<th>Lentigo maligna melanoma (LMM situ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uniform</td>
<td>Uniform; orderly</td>
<td>Monomorphous; orderly</td>
<td>Polymorphous; multiple patterns</td>
</tr>
<tr>
<td>Skin surface not preserved; papular, smooth, or hyperkeratotic</td>
<td>Skin surface preserved; flat</td>
<td>Skin surface preserved; flat</td>
<td></td>
</tr>
<tr>
<td>Regular; heavy, prominent; heavy pigment network; brown globules of variable size, haphazardly spaced</td>
<td>No pigment pattern, uniformly steel blue</td>
<td>Regular, crisp pigment at periphery; in the center pigment network is usually obscured by uniform pigmentation</td>
<td>Prominent but highly irregular pigment network, often obscured by intense uniform pigmentation; black dots at periphery</td>
</tr>
<tr>
<td>Pigment network stops abruptly at periphery around entire circumference; no pseudopods; no radial streaming</td>
<td>Usually regular, ill defined</td>
<td>Pigment network thins out at periphery; simple outline; no pseudopods; no radial streaming</td>
<td>Pigment network stops abruptly at the edge; no pseudopods; radial streaming may be present</td>
</tr>
<tr>
<td>Bizarre but regular, always in the center</td>
<td>Absent</td>
<td>Absent</td>
<td>White and pink regions of depigmentation with irregular outline</td>
</tr>
</tbody>
</table>

shadowed by a uniform and irregular brown to black pigmentation that obscures all other details (Fig. 11). Pseudopods and radial streaming are absent from dysplastic nevi.

Type II dysplastic nevi reveal no pigment network but appear to consist of aggregated brown globules and black dots (Fig. 14, a, b, and c). In contrast to “normal” junctional or compound nevi (Fig. 13), these globules are of different size, haphazardly spaced, and often particularly dense at the periphery of the lesion (Fig. 14, c). Black dots are present (Fig. 14, b) and irregular areas of hypopigmentation may occur both in the center and at the periphery (Fig. 18, a). Often there is a combination of central hyperpigmentation or depigmentation and aggregated brown globules at the periphery, which results in a target lesion–like appearance (Fig. 14).

**Lentigo simplex and nevoid lentigo:** Lentigo simplex is a flat, relatively monomorphous brown to black lesion with a normal skin texture. The pigment network is prominent and regular (Fig. 12) and is sometimes overshadowed by intensively colored patches of pigmentation. Brown globules and black dots are absent. The margin of the lesions is regular or slightly irregular, with the pigment network usually thinning out into the surrounding normal skin. There are no pseudopods nor radial streaming.

**Lentigo maligna:** The flat lesions show a normal skin texture but appear polymorphous. The most striking feature is a prominent but highly irregular and intense pigment network that often appears broken up and shows follicular accentuation. Brown globules are absent, whereas black dots are usually found in the center and at the periphery. The pigment network is occasionally obscured by intensively colored patches of uniform pigmen-
**Table I. Cont'd**

<table>
<thead>
<tr>
<th>Type of lesion</th>
<th>Lentigo maligna melanoma (LMM invasive)</th>
<th>Dysplastic nevus (I + II)</th>
<th>Superficial spreading melanoma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polymorphous; multiple patterns</td>
<td>Polymorphous</td>
<td>Polymorphous; multiple patterns</td>
<td>Skin surface not preserved; slightly elevated, irregular</td>
</tr>
<tr>
<td>Skin surface preserved in flat areas; loss of normal skin surface in nodular portions</td>
<td>I: Flat; II: macular with papular component; skin surface not preserved; irregular</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Highly irregular, prominent pigment network, black dots at periphery; loss of pigment network in nodular areas</td>
<td>I: Prominent pigment network, focally irregular; brown globules of variable size haphazardly spaced; patches of uniform hyperpigmentation; black dots. II: No pigment network; irregular brown globules aggregated in center or/and periphery; irregular depigmentation; black dots, target lesion–like appearance</td>
<td>Irregular, prominent pigment network; brown to black globules of variable size haphazardly spaced; often obscured by intensely colored patches; black dots at periphery; areas of uniform pigmentation vary in size and range in color from brown to blue-gray or black</td>
<td></td>
</tr>
<tr>
<td>Pigment network stops abruptly at the edge; pseudopods; radial streaming</td>
<td>I + II: Irregular, semicircular extensions at periphery; focally pigment network stops abruptly at periphery; peripheral aggregation of brown globules; no radial streaming</td>
<td>Pigment network irregular, stops abruptly at the edge; pseudopods and radial streaming</td>
<td></td>
</tr>
<tr>
<td>White and pink regions of depigmentation with irregular outline</td>
<td>I: Not frequent. II: Irregular, center, and periphery</td>
<td>Bizarre; pink or white</td>
<td></td>
</tr>
</tbody>
</table>

Lentigo maligna melanoma: Lentigo maligna melanoma exhibits basically the same criteria as its noninvasive precursor counterpart, lentigo maligna (see above), but the features of the former are more pronounced with regard to both intensity and irregularity. In the nodular portions of the lesion the normal skin surface is not preserved in that it may be irregular, smooth, or scaly and the pigment network is lost. White areas of regression with steel blue, pink, and gray areas are present. In addition, pseudopods at the border of the lesions and radial streaming are usually prominent.

Superficial spreading melanoma: Superficial spreading melanoma is first seen as a polymorphous, irregular, ill-defined pigmented skin lesion characterized by a particular variability of color ranging from black and brown to gray-blue and red to white. The normal skin surface is disrupted and small papules are present. Black dots, present in the center and at the periphery of the lesion, coalesce to uniform black areas (Fig. 15), obscuring all other pigment patterns. When visible, the pigment network is prominent and irregular (Fig. 9, a). Pseudopods are common and radial streaming (Figs. 15, a and 18, c) is the most characteristic feature of superficial spreading melanoma. Brown globules, when present, are of different sizes and haphazardly spaced. Bizarre flat or depressed pink, white, or gray areas of depigmentation complete the heterogeneous appearance of superficial spreading melanoma.

*Histopathologic criteria in diagnosing superficial spreading melanoma in situ and differentiating it from atypical melanocytic hyperplasia or dysplastic nevus were those of Ackerman and Mihara. 10
Type of lesion

<table>
<thead>
<tr>
<th>Nodular melanoma</th>
<th>Angioma; angiokeratoma</th>
<th>Pigmented basal cell carcinoma</th>
<th>Seborrheic wart</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polymorphous or uniform</td>
<td>Monomorphous; orderly</td>
<td>Polymorphous</td>
<td>Polymorphous</td>
</tr>
<tr>
<td>Skin surface not preserved; nodular, smooth, or hyperkeratotic</td>
<td>Skin surface not preserved; papular</td>
<td>Skin surface not preserved; macular or papular; irregular</td>
<td>Skin surface not preserved; verrucous, horny plugs</td>
</tr>
<tr>
<td>Usually uniformly pigmented; however, at periphery usually a thin rim of prominent and irregular pigment network; black dots at peripheral areas of uniform pigmentation range from gray, blue, brown to black*</td>
<td>No pigment pattern</td>
<td>No pigment pattern except black dots; telangiectasia</td>
<td>No pigment pattern except black dots and streaks of pigment; brownish appearance</td>
</tr>
<tr>
<td>Pigment network irregular, stops abruptly at the edge; pseudopods either black or blue; radial streaming</td>
<td>Regular, well defined</td>
<td>Irregular; no pigment network; no pseudopods; no radial streaming; telangiectasia</td>
<td>Irregular</td>
</tr>
<tr>
<td>White and pink regions with irregular outline; often speckled with black and blue dots</td>
<td>Absent</td>
<td>Irregular</td>
<td>Absent</td>
</tr>
</tbody>
</table>

perifical spreading melanoma in situ basically exhibits epiluminescence microscopy patterns identical to those seen in superficial spreading melanoma but lacks small papules and the irregularity is less pronounced (Fig. 18, c).

**Nodular melanoma:** Nodular melanoma appears as a polymorphous nodular lesion. The texture of normal skin is lost. The nodules are brown, gray, blue, or black: the pigment network is usually obscured by uniform black, but if it is visible it is found only in the periphery of the lesion and is irregular and prominent. Black dots are found only in the periphery. White, pink, or blue areas of depigmentation occur focally (see nodular portion of Fig. 9). The border of the lesion is often but not always characterized by an abrupt stop of the pigment network or the uniform black pigmentation. Typical and diagnostic features are pseudopods (Fig. 16, a) and radial streaming (see also Fig. 2, a in the accompanying paper*). Amelanotic nodular melanomas lack pigment and appear as skin-colored nodules but may exhibit some features of their pigmented counterpart at the border.

**Acrolentiginous melanoma:** Acrolentiginous melanoma when first seen presents epiluminescence microscopy features of lentigo maligna melanoma, superficial spreading melanoma, or nodular melanoma at the particular (acral) body sites (Figs. 2 and 3).

**Pattern analysis of nonmelanocytic pigmented skin lesions**

**Angioma and angiokeratoma:** These lesions are usually regular, monomorphous, and the surface is smooth or crusted (angioma) or hyperkeratotic (angiokeratoma). When compressed by the oil immersion technic they lose their black color, which yields to blue, red, or white. Thrombosed lesions remain uniformly black, there is no pigment network in the periphery, and brown globules, black

*Illustrations of some of these lesions are shown in the accompanying paper.*
dots, radial streaming, and pseudopods are absent (see Figs. 3 and 4 in the accompanying paper).  

**Pigmented basal cell carcinoma:** These lesions share many features with superficial spreading melanoma in that they are irregular and have a polymorphous appearance, including irregular outlines, irregular depigmentation, and the presence of black dots. They differ from melanocytic pigmented skin lesions by the lack of a pigment network, brown globules, radial streaming, and pseudopods. The presence of prominent telangiectasia is another clue to suggest pigmented basal cell carcinoma (see Figs. 5, 6, 9, and 10 in the accompanying paper).  

**Seborrheic warts:** Seborrheic warts are also irregular, somewhat polymorphic, and sometimes exhibit black dots. However, a pigment network is absent and instead there is some streaky pigmentation; there are no brown globules, and radial streaming and pseudopods do not occur. In contrast to all other pigmented skin lesions, seborrheic warts in addition usually exhibit prominent horny plugs (see Figs. 15 and 16 in the accompanying paper).  

**DISCUSSION**  

In the present paper we describe the appearance of pigmented skin lesions as viewed by epiluminescence microscopy and define criteria that we believe permit a distinction between benign and malignant growth patterns. Epiluminescence microscopy provides for a more detailed inspection of the surface of pigmented skin lesions and, by using the oil immersion technic, which renders the epidermis translucent, opens a new dimension of skin morphology by including the dermoepidermal junction into the macroscopic evaluation of a lesion. In the last 4 years we have studied more than 3000 pigmented skin lesions, some of them clinically typical and easy to diagnose by clinical criteria and some of them representing a diagnostic problem.  

Studying classical pigmented skin lesions initially and correlating their epiluminescence microscopy appearance with histopathology has permitted us to define regular features of such lesions that are not readily apparent to the naked eye. In melanocytic pigmented skin lesions these features include specific patterns of pigmentation, distribution, color, and intensity of pigmentation as well as configuration, regularity, and other characteristics of the margin and surface of such lesions (Table I). Whereas none of the features described are absolute criteria and per se diagnostic for a given melanocytic pigmented skin lesion, their combination results in patterns of morphologic appearance that we have found characteristic for the types of lesion investigated. Moreover, these patterns were not only found in well-developed, clinically classical lesions but also in small and early pigmented skin lesions that did not exhibit the entire clinical spectrum required for a reasonably reliable clinical diagnosis. They were absent from certain nonmelanocytic pigmented skin lesions that clinically notoriously represent a differential diagnostic problem.  

Epiluminescence microscopy is certainly not required for the diagnosis of advanced and clinically typical forms of melanoma or benign pigmented skin lesions where visual inspection will usually yield a correct diagnosis. It is the clinically equivocal lesion where an improvement of the available diagnostic criteria is needed that is the field where we advocate establishment of epiluminescence microscopy as a regular diagnostic technic. This includes: (1) the differential diagnosis of melanoma from highly pigmented basal cell carcinomas, small angio keratomas, and smooth and highly pigmented flat seborrheic keratoses; (2) the diagnosis of very early and small pigmented skin lesions that have not yet sufficiently developed the clinical features currently used as criteria to define the benign or malignant nature of the lesion; and (3) the assessment of dysplastic nevi. In order to prove the validity of this suggestion we have put the criteria of pattern analysis of pigmented skin lesions by epiluminescence microscopy described in this paper to test in a separate study of small and clinically equivocal pigmented skin lesions. As will be described in the accompanying paper, we have indeed found that the accuracy of clinically diagnosing early malignant melanoma and dysplastic nevi can be considerably improved by the use of epiluminescence microscopy.
REFERENCES


ABSTRACTS

Lying to military physicians about risk factors for HIV infections

A comparison of risk factor classification in 20 human immunodeficiency virus (HIV)-infected men interviewed first by military and later by civilian investigators revealed homosexual/bisexual 20% versus 70%, intravenous drug abusers, 5%/15%, and undetermined, 75%/15%. It is suggested that risk factors in the military personnel are not significantly different from nonmilitary individuals.

Isotretinoin treatment of rosacea
Turjanmaa K, Reunala T: Acta Derm Venereol (Stockh) 1987;66:89-91

Seventeen of 20 patients with severe rosacea treated with isotretinoin, 0.5-1 mg/kg/day for 3 to 6 months, had no relapse during follow-up of 1 year. All patients had good or excellent responses while on therapy.

Cryotherapy for dermatofibromas

Twenty-seven patients with 35 dermatofibromas had good or excellent results in over 90% of the lesions. The patients were treated with liquid nitrogen spray to produce a visible freezing of the lesion at 2 mm border of surrounding skin for 30 seconds.

The frequency of lupus anticoagulant in systemic lupus erythematosus—a study of sixty consecutive patients by activated partial thromboplastin time, Russell viper venom time, and anticardiolipin antibody level

In recent reviews, the frequency of lupus anticoagulant or related antiphospholipid antibodies in patients with systemic lupus erythematosus has varied from 21% to 65%, whereas in earlier reviews the percentage was 6% to 18%. In this study of 60 patients, lupus anticoagulant was found in 6.7% and anticardiolipin antibody assay in 25%.

The restaurant syndromes

Five major factors cause restaurant syndromes: food allergens, sulfites, monosodium glutamate, tartrazine, and scombroidosis (and other seafood poisoning). Allergic reactions to food such as peanuts have produced fatalities in minutes through an IgE-mediated reaction. An extremely rapid onset within minutes after ingestion of symptoms consisting of flushing, bronchospasm, and hypotension is consistent with a sulfite reaction. Bronchospasm and urticaria in a patient with a history of aspirin intolerance suggest tartrazine sensitivity. Flushing, urticaria, pruritus, gastrointestinal complaints, or bronchospasm following a fish meal implies scombroidosis, signetra, or other seafood poisoning. The treatment of choice for acute reactions is epinephrine followed by an antihistamine.