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Dermoscopy: Alternative Melanocytic Algorithms—The ABCD Rule of Dermatoscopy, Menzies Scoring Method, and 7-Point Checklist

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In the year 2000, the Second Consensus Meeting on Dermoscopy was held over the Internet. Experts from around the world were asked to evaluate melanocytic, nonmelanocytic, benign, and malignant skin lesions using pattern analysis, the ABCD rule of dermatoscopy, Menzies scoring method, and the 7-point checklist.

One hundred twenty-eight digital dermoscopic images were randomly subdivided into a training set of 20 images in which the unifying concepts of pattern analysis, the ABCD rule of dermatoscopy, Menzies scoring method, and the 7-point check list were presented. Those melanocytic algorithms were then used to evaluate another 108 cases. The results of the Second Consensus Meeting were presented at the First World Congress of Dermoscopy held in Rome, Italy, March 2001 and in an atlas that outlined the results and illustrated all of the cases.[1,2]

One of the main conclusions from the Second Consensus Meeting was that the four melanocytic algorithms studied were all valid ways to evaluate pigmented skin lesions with dermoscopy. This article will present the unifying concepts of the ABCD rule of dermatoscopy, Menzies scoring method, and the 7-point checklist. Other less-well-known and studied dermoscopic algorithms will not be presented.[3–5]

ABCD Rule of Dermatoscopy

The ABCD rule of dermatoscopy was the second algorithm developed after pattern analysis and was the first attempt to simplify the process. After a rigorous multivariate analysis of 31 dermoscopic criteria, four criteria were found to be significant cofactors for diagnosing melanoma, and they include asymmetry (A), borders (B), colors (C), and different structural components (D).[6] It is a semiquantitative, mathematical approach that gives points for the criteria identified in a lesion and a formula to determine the total dermatoscopy score (TDS) for each lesion.[7,8] A TDS <4.75 in most cases would be benign. A TDS of 4.80–5.45 is suggestive but not diagnostic of melanoma. A lesion with a score in this range can either be excised or followed. With the development of digital systems, a database of lesions that a clinician wishes to follow can now be created. Side-by-side computer-monitor comparisons of the baseline and follow-up images can then be made to look for significant dermoscopic changes overtime. (Fig 1)[9–11] A TDS >5.45 is highly suspicious but not 100% diagnostic of melanoma. Not uncommonly, it is possible to have a false high TDS with benign lesions (Table 1).[12]

Before dismissing a lesion as being benign after applying the ABCD rule of dermatoscopy, one should try to identify clues that are often seen in melanoma, such as white or bluish-white color, which might indicate regression areas or melanoma-specific criteria such as pseudopods. Other important clues in a lesion with an equivocal TDS are the atypical vascular pattern, which contains dotted and irregular, linear, red vessels (Fig 2) or milky-red areas. Milky-red areas can be localized or diffuse areas of reddish-white color that can be featureless or contain reddish-brown, out-of-focus or blurry-appearing globules (Fig 3). Both of these vascular patterns are not diagnostic of melanoma but are considered high-risk criteria.[8,13]

Some lesions should always have a pattern recognition diagnosis, and the ABCD rule of dermatoscopy should not be used. The saccular pattern seen in hemangiomas, the globular or cobblestone pattern of compound nevi, and the starburst or targetoid pattern of Spitz nevi are examples of that dermoscopic concept. If the ABCD rule is applied to these lesions, a false high TDS will often result (Fig 4).[8]

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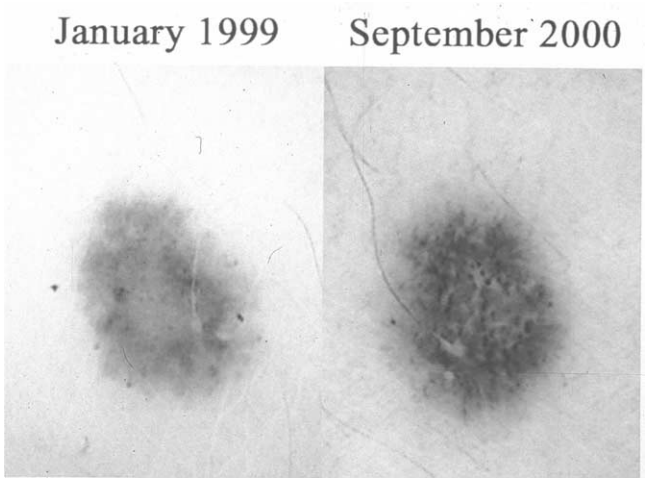

Figure 1. *Side-by-side computer-monitor comparison of these digital images demonstrates significant dermoscopic changes over time. The follow-up image is darker and larger, with irregular dots and globules. Even though the patient was performing regular self-examinations, he did not notice a change in this lesion, which was located on the posterior aspect of his left upper arm. This in situ melanoma did not demonstrate any melanoma-specific criteria in the baseline image.*

Asymmetry (A)

To determine the asymmetry score, the lesion is visually divided into two 90° right-angle axes and then assigned a score ranging from 0 for a lesion that is completely symmetrical in contour, color, or structure (Fig 5), to 1 point for a lesion that is asymmetric in one axis (Fig 6), and a maximum of 2 points for a lesion that is asymmetric in both axes (Fig 7). When the axes are created visually in mind, it should be done with the idea of creating the lowest possible asymmetry score. One simple way to determine the symmetry of a lesion is to see whether each side of the lesion is a mirror image of the other for any of the criteria (contour, color, or structure). If it is not symmetrical in appearance for any or all of the criteria, it would then be considered asymmetric in that axis and receive 1 point. Dysplastic nevi and early melanomas can appear symmetrical when examined with the naked eye, however, the same lesions often have significant asymmetry of colors and/or structures when dermoscopy is used.

Table 1. Lesions that can have a false high total dermatoscopy score (TDS)

Melanocytic nevi
Dysplastic
Congenital
Spitz
Recurrent
Dermatofibroma
Ink-spot lentigo
Actinic lentigo
Pigmented actinic keratosis

Figure 2. *An invasive acral lentiginous melanoma that lacks primary criteria to identify it as being a melanocytic lesion (pigment network, globules, streaks); however, one clue that it is a melanoma is the well-defined atypical vascular pattern.*

Borders (B)

To determine the border score, the lesion is visually divided into eight pie-shaped segments, or eighths, and then the number of segments is counted in which there is an abrupt cutoff at the margins of the pigment pattern. The pigment pattern has never been formally defined, however, it signifies criteria such as pigment network, branched streaks, dots, globules, or diffuse pigmentation. It is not simply a well-demarcated lesion that is assigned border points. The score can range from 0 to 8 (Figs 8 and 9).

Colors (C)

Colors to look for include red, white, light and dark brown, blue-gray, and black. White should be counted only if it is lighter than the surrounding skin and should not be confused with hypopigmentation that is commonly seen in all types of melanocytic lesions. Each

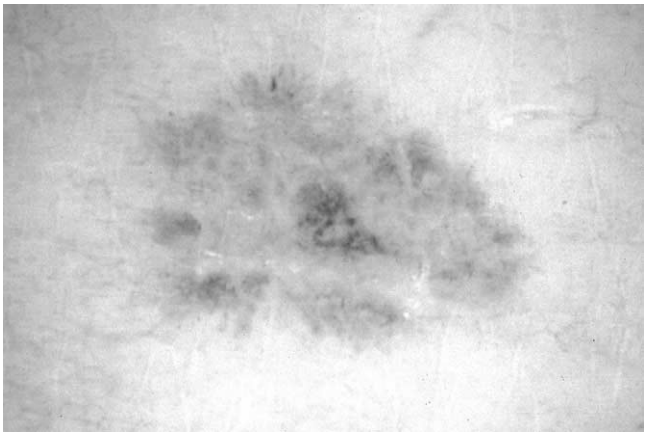

Figure 3. *The presence of milky-red areas was the only dermoscopic clue that prompted excision of this early invasive level II–III 0.25 mm-deep superficial spreading melanoma.*

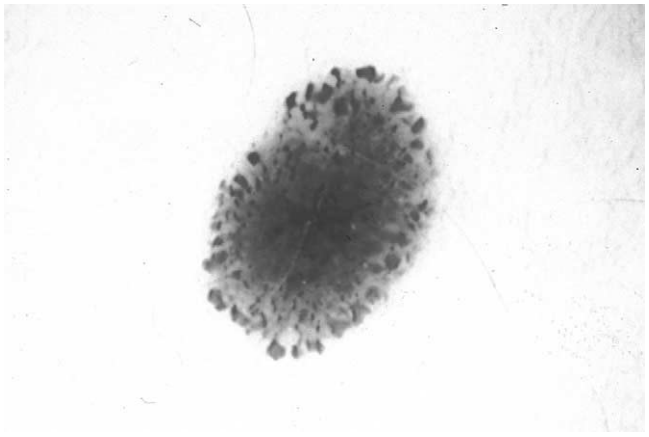

Figure 4. *In this benign nevus, the pattern of criteria seen with dermoscopy immediately brings the diagnosis of a Spitz nevus to mind. If the ABCD rule of dermatoscopy is used, a false high total dermoscopy score (TDS) will result: A = 1 × 1.3 = 1.3; B = 8 × 0.1 = 0.8; C = 3 × 0.5 = 1.5 (light brown, dark brown, black); and D = 4 × 0.5 = 2.0 (homogeneous areas, dots, globules, streaks), for a TDS = 5.6*

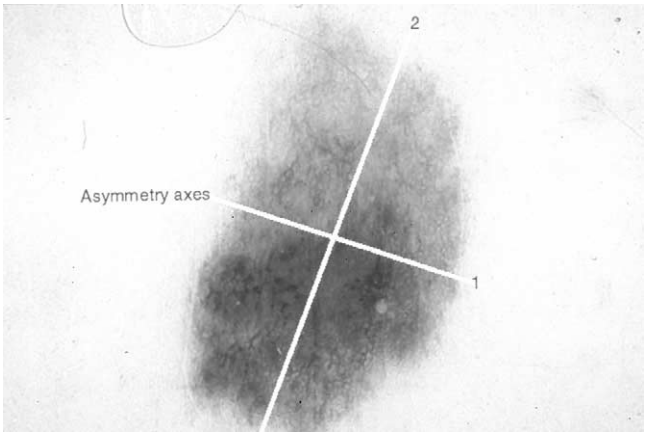

Figure 6. *This benign nevus demonstrates asymmetry for contour, color, and structure in one axis. The lower half of the lesion is clearly not a mirror image of the upper half. Interobserver agreement might not be 100%. An experienced dermoscopist might give this lesion an asymmetry score of 2 because the left side is not exactly a mirror image of the right.*

color is assigned 1 point, and the total score ranges from 1 to 6. A lesion with five or six bright and distinct colors is a significant clue that it is a melanoma (Fig 7).

The colors seen dermoscopically depend on the location of melanin in the skin.[8,13] Black means that the melanin is in the epidermis. This is not always an ominous sign because many benign or dysplastic nevi often contain black color. When melanin is present at the level of the dermoepidermal junction, it appears light or dark brown. Gray indicates melanin at the level of the papillary dermis, which can be seen with melanophages. Melanophages are a pattern-recognition diagnosis with distinct-appearing brown or gray dots that are irregular in size and shape, often described as "pepperlike" (Fig 10). If melanophages are seen and no other high-risk criteria are identified, the diagnosis would favor postinflammatory hyperpigmentation. With increasing depth into the dermis, the colors appear steel gray or dark-bluish. White can represent hyperkeratosis or the scarring seen with regression. Yellow can be caused by hyperkeratosis, and red indicates an inflammatory process that is commonly seen in dysplastic nevi or melanoma.

Identifying colors can have practical clinical applications. If a flat, black lesion contains black and/or dark brown colors and structures with dermoscopy, there is a good statistical chance if it is a melanoma, it will be an in situ or an early invasive lesion. This clinical and dermoscopic information can be then used to help plan

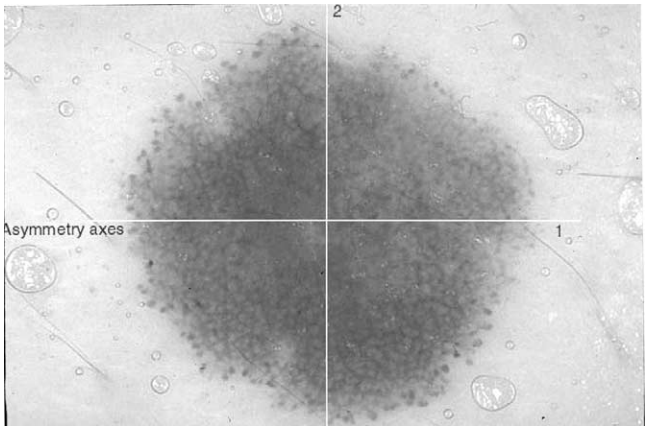

Figure 5. *The left side of this lesion is a mirror image of the right (contour, color, structure), and the lower half is a mirror image of the upper half, therefore, it has an A score of 0.*

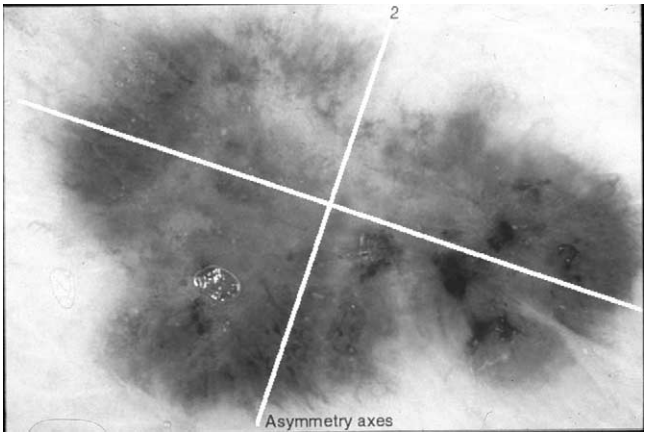

Figure 7. *This invasive melanoma clearly is asymmetric for contour, color, and structure in both axes and therefore is assigned 2 points in the A score. Five colors are present (light brown, dark brown, blue-gray, black, and white). The white is counted because it is lighter than the surrounding skin. Homogeneous or structureless areas, branched streaks, dots, and globules give this melanoma a D score of 4. At times, these criteria are prominent and easy to identify, and at other times they might be not so obvious.*

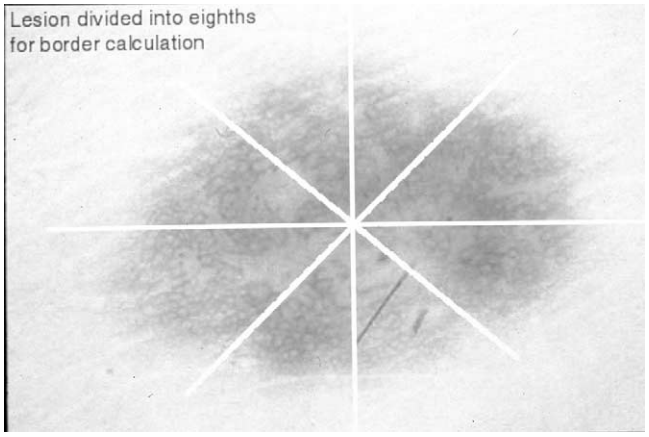

Figure 8. *This benign nevus is visually divided into eighths. No criterion is seen with a sharp demarcation at the border in any segment, therefore, it has a B score of 0.*

the surgical approach and for patient reassurance. On the other hand, if colors indicating deeper involvement are identified, the prognosis is potentially more ominous![13–15]

Different Structural Components (D)

The clinician should look for a pigment network, branched streaks (thickened and branched pigment network anywhere in the lesion, not only at the borders), structureless or homogeneous areas (color, but no structures such as pigment network, branched streaks, dots, or globules), dots, and globules. Structureless or homogeneous areas should be larger than 10% of the lesion to be counted. Branched streaks and dots are counted only when more than two are clearly seen, yet the presence of a single globule is sufficient to be counted as being present in a lesion. The total different structural component score ranges from 1 to 5 (Fig 7).

After identifying all of the criteria, the TDS is calculated by multiplying the points by conversion factors: (A × 1.3) + (B × 0.1) + (C × 0.5) + (D × 0.5 = TDS (Table 2). In most cases, an experienced clinician can calculate the TDS rapidly, and the results can then be noted in the patient's record.[16]

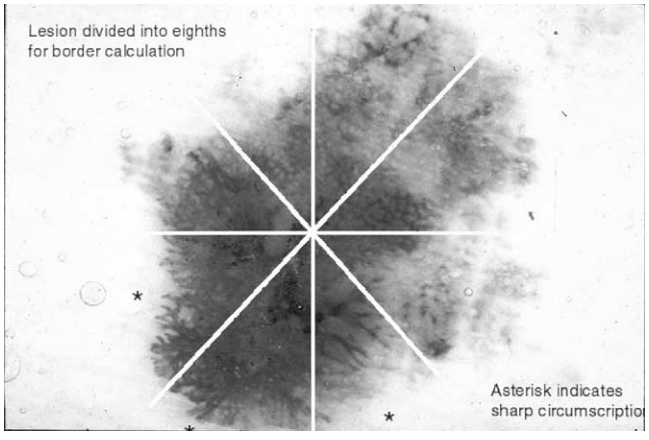

Figure 9. *This melanoma has a B score of 3. There are areas in which there is a sharp cutoff at the margins of the pigment network and areas where the pigment network gradually thins at the periphery.*

Figure 10. *The "pepperlike" small, irregular, gray dots are diagnostic of melanophages. This pattern is commonly seen, and if it is the only significant criterion present, it is not necessary to perform a biopsy.*

Menzies Scoring Method

Menzies scoring method is a variation on the theme of pattern analysis and is another attempt to simplify the analysis of criteria seen with dermoscopy. If a lesion demonstrates symmetry of pattern within the lesion (not necessarily symmetry of contour) and the presence of a single color, then in most cases it would not be a melanoma. On the other hand, if a lesion demonstrates asymmetry of pattern and more than one color and if 1 or more of 9 positive features can be identified, then the lesion should be considered a melanoma (Table 3).

All of the criteria in the Menzies method are scored as categorically present or absent. This reduces the intra- and inter-observer errors seen when criteria are graded. Seventy-two dermoscopic features were studied in both benign and malignant pigmented skin lesions to identify criteria rarely and criteria often associated with melanoma. The criteria were then tested on 45 invasive melanomas and 119 atypical nonmelanomas and found to have a sensitivity of 92% and specificity of

Table 2. Calculation of the ABCD rule of dermatoscopy

Asymmetry (A) × 1.3 +
Borders (B) × 0.1 +
Colors (C) × 0.5 +
Different structural components (D) × 0.5 = TDS
Total dermatoscopy scores (TDS)
<4.75 = Benign
4.8–5.45 = Suspicious for melanoma
>5.45 = Highly suspicious for melanoma

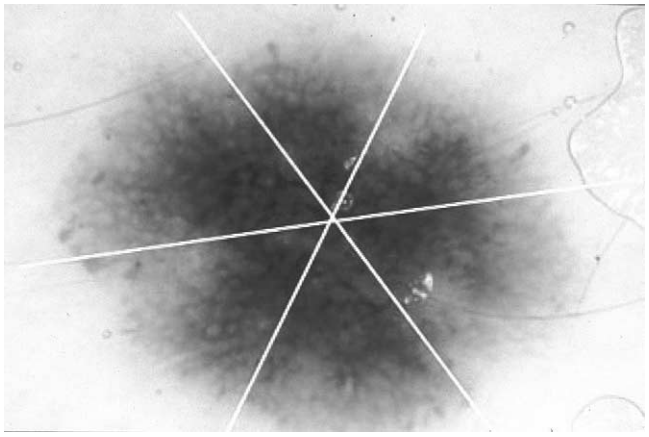

Figure 11. *This benign nevus demonstrates symmetry of pattern across all axes drawn through the center of the lesion.*

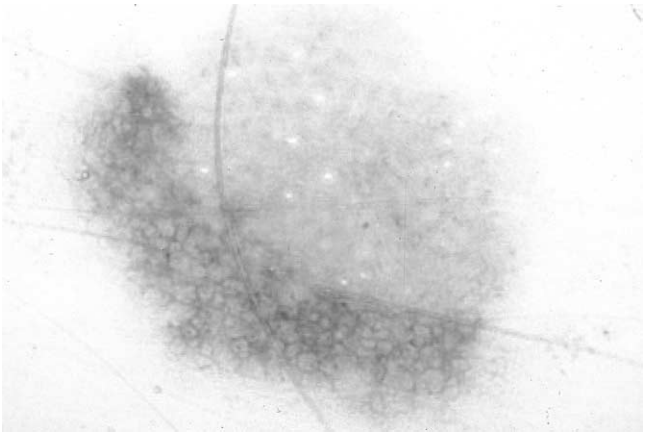

Figure 12. *There is asymmetry of pattern along the long axis. The pigment network is clearly different on the right side of the lesion.*

71% for invasive melanomas, with a median Breslow thickness of <0.7 mm.[2,17–21]

Symmetry of pattern refers to symmetry or asymmetry of colors and/or structures seen in a lesion along any axis drawn through the center of the lesion (Figs 11 and 12). Most invasive melanomas demonstrate asymmetry of colors and structures within the lesion (Fig 13).

The colors scored include black, gray, blue, red, dark brown, and tan. In the ABCD rule of dermatoscopy, white is assigned 1 point in the color score, yet in this algorithm white is not counted as a color. Since melanin occupies multiple levels in invasive melanomas, if only one color is present, in most but not all cases the lesion would be classified as benign.

Positive Features

BLUE-WHITE VEIL This refers to irregular, confluent, structureless, blue pigmentation with an overlying "ground-glass" or hazy appearance. By definition, it cannot occupy the entire lesion. At times, the Consensus Group found it difficult to differentiate the blue-white veil from the bluish-white color that can be seen in regression areas.

MULTIPLE BROWN DOTS This refers to focal collections of multiple, dark brown dots, not to be confused with dark-brown globules that are larger and commonly found in benign nevi. The size and color of this criterion are in the eye of the beholder and is a potential source of misinterpretation.

PERIPHERAL BLACK DOTS AND GLOBULES Black dots and/or globules found at or near the periphery of a lesion. They must be black, not brown.

RADIAL STREAMING AND PSEUDOPODS[21] These can be considered variations on the theme of the same criterion. They are radially oriented or bulbous, fingerlike extensions of the pigment network at the periphery of a lesion. They can also arise from areas of diffuse pigmentation. By definition, they should not be scored if

Table 3. *Menzies Scoring Method*

Benign
Symmetry of pattern
One color
Melanoma
Asymmetry of pattern
More than 1 color
One to 9 positive features
Positive features
Blue-white veil
Multiple brown dots
Pseudopods
Radial streaming
Scarlike depigmentation
Peripheral black dots/globules
Multiple colors (5 or 6)
Multiple blue/gray dots
Broad pigment network

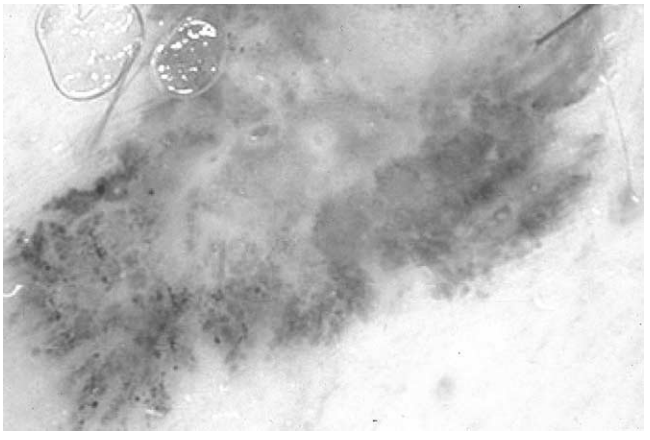

Figure 13. *A dermoscopic diagnosis of melanoma can be made for this lesion because it is asymmetric, it has more than one color, and two positive features are present (white scarlike areas, peripheral brown dots).*

Table 4. Seven-point checklist

Major criteria	*Points*
Atypical pigment network	2
Atypical vascular pattern	2
Blue-whitish veil	2
Minor criteria	
Irregular streaks (pseudopods/radial streaming)	1
Irregular pigmentation	1
Irregular dots/globules	1
Regression areas	1
Seven-point total score	
<3 = nonmelanoma	
≥3 = melanoma	

they are seen regularly or symmetrically around the lesion. This is a potential source of misdiagnosing melanoma because this criterion can be seen symmetrically distributed in some melanomas.[13]

SCARLIKE DEPIGMENTATION Superficial spreading melanomas have a high incidence of regression. This criterion can be seen as bone-white or milky-white color, and represents true scarring.

MULTIPLE (FIVE OR SIX) COLORS Black, gray, blue, red, dark brown, and tan. White is not counted as a color.

MULTIPLE BLUE/GRAY DOTS This represents melanophages that can be seen in regression areas. They appear as foci of multiple "pepperlike," small, blue or gray dots, irregular in size and shape (not globules).

BROADENED NETWORK Localized pigment network in which the line segments are thickened and irregular.

With Menzies algorithm, there is an 8% false-negative melanoma diagnosis rate. Problems can involve in situ, early invasive, and hypomelanotic melanomas. With all of their "featureless" melanomas, Menzies patients had a history of recent change that they felt would help increase the index of suspicious of a potentially high-risk lesion. It has been my experience that patients with featureless, hypomelanotic or pink melanomas were not aware that their lesions had changed clinically or even existed.

The 7-Point Checklist

This is another variation on the theme of pattern analysis but with a point system.[12,13] There are fewer criteria to identify and analyze than in pattern analysis, and the point system is less complicated than that in the ABCD rule of dermatoscopy. Major and minor criteria in a lesion must be identified. Major criteria receive 2 points each and minor criteria receive 1 point. A score of 3 or greater has a 95% sensitivity of being melanoma. The 7-point checklist does not include criteria not associated with melanoma or include criteria used to differentiate pigmented skin lesions that are not melanocytic, such as seborrheic keratosis, or basal cell carcinoma (Table 4) (Figs 14 and 15).

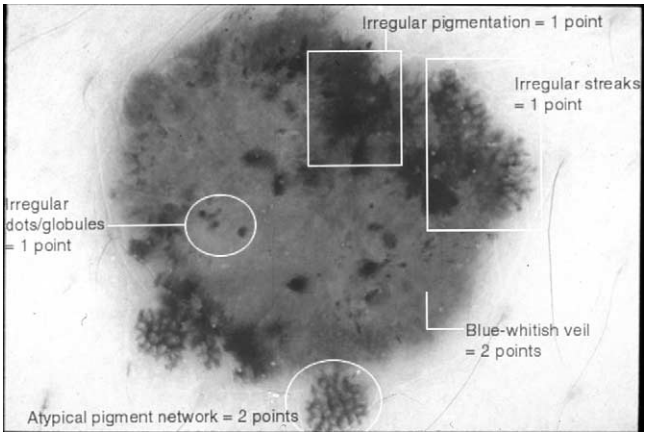

Figure 14. *Analysis using the 7-point checklist.*

Major Criteria

ATYPICAL PIGMENT NETWORK Black, brown, or gray thickened and irregular line segments anywhere in a lesion.

BLUE-WHITISH VEIL Irregular, confluent, gray-blue to whitish-blue diffuse pigmentation that can be associated with pigment network alterations, dots/globules, or streaks. This differs from the Menzies definition in which the blue color should be featureless.

ATYPICAL VASCULAR PATTERN Linear-irregular and/or dotted red vessels not seen in regression areas.

Minor Criteria

IRREGULAR STREAKS Pseudopods or radial streaming irregularly arranged at the periphery of the lesion.

IRREGULAR PIGMENTATION Black, brown, or gray featureless areas with irregular shape and/or distribution.

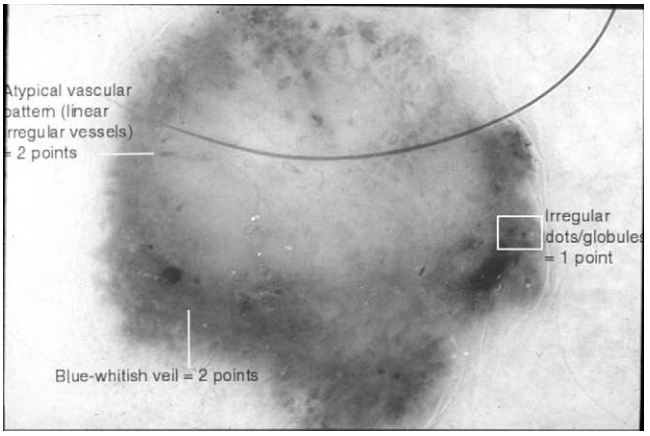

Figure 15. *Analysis using the 7-point checklist.*

IRREGULAR DOTS/GLOBULES Black, brown, or gray round to oval, variously sized structures irregularly distributed in the lesion.

REGRESSION STRUCTURES White scarlike areas and/or blue pepperlike areas (gray-blue areas, multiple blue-gray dots). Not uncommonly, melanomas can have both color patterns of regression in a lesion.

Discussion

In the original article presenting the ABCD rule of dermatoscopy, [6] the authors believed that the algorithm could be easily learned and that the TDS could be easily and rapidly calculated. In their study, they had a diagnostic accuracy of 92.2%, sensitivity of 97.9%, and specificity of 90.3%.

Articles in the recent literature illustrate good and bad points of the ABCD rule of dermatoscopy. Lorentzen et al[22] presented data that the ABCD rule does not improve the diagnostic accuracy of melanoma. Even though the algorithm was developed to simplify the learning process and increase the sensitivity and specificity of diagnosing pigmented skin lesions, these authors found that the ABCD rule was not superior to pattern analysis, and fewer melanomas were identified with this method.

Argenziano et al[12] made a comparison of the ABCD rule of dermatoscopy, their 7-point checklist, and pattern analysis. They found that the 7-point checklist had an overall sensitivity of 95% and specificity of 75% compared with an 85% sensitivity and 66% specificity with the ABCD rule and a 91% sensitivity and 90% specificity with pattern analysis. Compared with the ABCD rule, they found that the 7-point method allowed less-experienced observes to obtain higher diagnostic accuracy values. They also concluded that the 7-point checklist provided a simplification of standard pattern analysis and, as with the ABCD rule, it could be easily learned and easily applied and was a reliable way to diagnose melanoma.

Diagnosing melanoma in an early, thin stage offers patients their best chance for survival therefore, the clinical and dermoscopic diagnosis of small, equivocal lesions is essential. Pizzichetta et al[23] presented data that the ABCD rule was not an accurate way to diagnose small, melanocytic skin lesions, including melanoma.

In my experience, even though the TDS can be easily and rapidly calculated, it yields an unacceptably high number of false high scores. Lorentzen et al[24] presented data on a study of the asymmetry component of the ABCD rule. The asymmetry of a melanocytic lesion is an important indicator of a possible melanoma and contributes significantly to the diagnosis of melanoma by using the ABCD formula. They thought that determining the asymmetry of a lesion was observer dependent and could not be assessed objectively and that there was no "gold standard" to determine this variable. They had four experts analyze the A component in 232 pigmented skin lesions. They found that the sensitivity of diagnosing symmetry in both axes ranged from 40% to 77%, 40%–70% for one-axis asymmetry, and 77%–92% for two-axis asymmetry. They also found that overestimation of asymmetry was more common than underestimation.

Argenziano et al[12] found 18 of 117 melanomas had TDSs <4.76 and were therefore not identified with this method (15% false-negative rate). They also found a 34% false-positive rate with 77 incorrectly assessed benign lesions.

For a significant number of dermoscopic images I have seen in books and articles over the years, I have been impressed how often I do not agree with the assessment given for the different components of the ABCD rule. The Internet Consensus Group also had the greatest difficulty applying this algorithm compared with pattern analysis, Menzies scoring method, and the 7-point checklist (unpublished data).

On the other hand, Feldman et al[25] used the ABCD rule of dermatoscopy to analyze 500 melanocytic lesions. Their data suggested that this algorithm greatly facilitates the evaluation of melanocytic lesions, and when the TDS is >4.2, melanoma should be considered.

Binder et al[16] recently reevaluated the ABCD rule. They studied the diagnostic performance of this method with dermatologists who had varying skill levels from novice to expert. The results of their study showed that the application of this algorithm significantly enhanced diagnostic ability in less-experienced dermatologists. In contrast, the diagnostic accuracy of dermatologists who were moderately to greatly experienced was not improved.

One clinically practical conclusion from their study was that the time needed for scoring an individual lesion ranged from 15 to 59 seconds. This represents an acceptable amount of time to apply this melanocytic algorithm in a busy clinical setting.

Westerhoff et al[26] used Menzies atlas[20] plus a 1-hour lecture using Menzies scoring method to train primary care physicians. Their goal was to see whether they could teach nondermatologists to use dermoscopy and to see whether it would improve their diagnosis of melanoma. Seventy-four practicing primary care physicians completed a pretest of 50 melanomas and 50 benign but atypical pigmented skin lesions. After training, there was a significant improvement in posttest versus pretest results for both the clinical diagnosis of melanoma (62.7% vs 54.6%) and the dermoscopic diagnosis of melanoma (75.9% vs 57.8%). No difference was found in the control group between posttest versus pretest clinical diagnosis of melanoma (53.7% vs 50.6%) or the dermoscopic diagnosis of melanoma (54.8% vs

52.9%). After dermoscopy training, there was a significant improvement in the diagnosis of melanoma using dermoscopy vs the clinical diagnosis (75.9% vs 62.7%). They were able to teach nonexpert, nondermatologists how to evaluate pigmented skin lesions using Menzies scoring method with very little training and concluded that all primary care physicians in countries where melanoma leads to significant mortality should be taught the technique.

With whichever algorithm is chosen, dermoscopy opens up a world of colors and structures that cannot be seen with the naked eye. This extra criteria should be put together with the patient's personal and family history plus the history and clinical appearance of a lesion before a decision for or against excision is made.

For those clinicians who keep up with the literature and use the technique, one point has proven to be consistently true. Even though dermoscopy is not 100% diagnostic of pigmented skin lesions and has its good and bad points, it significantly improves the clinical diagnosis of melanocytic, nonmelanocytic, benign, and malignant skin lesions and thus, melanoma. Dermoscopy is the standard of care in Europe. With one person dying of melanoma every hour in the United States, it should become the standard of care not only in our country but in every country around the world.

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