

Dermatoscopy: Chaos and Clues

A decision algorithm for pigmented skin lesions.

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The first references to dermatoscopy are from the 1920s, Saphier first using the term in 1923. It is now established that use of a dermatoscope in clinical practice increases diagnostic accuracy and at least in Australasia it is considered to be the standard of care in assessing patients with pigmented skin lesions. There is also increasing evidence that dermatoscopy is useful for the diagnosis of non-pigmented skin lesions. This article, based on a presentation at the 2013 Cosmetic Surgery Forum in Las Vegas, discusses an algorithm developed by collaboration between colleagues from the Medical University of Vienna, Austria and The University of Queensland, Australia, for the dermatoscopic assessment of pigmented skin lesions.¹

The chaos and clues algorithm was evaluated in a study of 463 consecutively treated pigmented skin lesions (including 29 melanomas, 20 of which were *in situ*) in a general practice in Australia. The algorithm was found to have a sensitivity of 90.6 percent and a specificity of 62.7 percent for the diagnosis of malignancy of any type in the test series used.²

DEFINING PATTERNS

Natural laws favor symmetry, and as malignant cells defy natural laws, not responding to normal growth-controlling feed-back mechanisms, they have a tendency to rapidly become asymmetrical, or chaotic. For the purpose of the method "Chaos and Clues" we define dermatoscopic chaos as asymmetry of structure and/or color, regardless of the outline.

This chaotic behavior acts at the clinical level as well as the dermatoscopic and dermatopathologic level so that the most valuable clinical sign of all is a break in pattern, a clinical expression of the chaotic behavior of malignant tissue. Malignant lesions turn up where not expected and may "break the pattern" in the area they arise in by virtue of size, shape and color. Also a lesion that looks like an evolved or created complex object should raise suspicion, as this is not expected in a benign lesion. See Figure 1.



Figure 1. Be suspicious of a lesion that looks like an evolved or created complex object.

With respect to dermatoscopic chaos, irregularity of shape does not matter. Also perfect symmetry is not expected in nature and is not required for a lesion not to be biologically symmetrical

Asymmetry has been a clue to malignancy in preceding methods, including the classic pattern analysis (Pehamberger, 1987), the ABCD method (Stolz, 1994), Menzies' Method (1996), the seven-point checklist (Argenziano, 1998), the 3-point checklist (Soyer/Argenziano, 2000), CASH (color, architecture, symmetry, and homogeneity, 2007), and Revised Pattern Analysis (RPA; Kittler, 2007). Classic pattern analysis has still not been surpassed in accuracy when applied by expert, but it is complex and there is no simple flow-chart method. Most of the methods require calculations, which make application in real practice cumbersome.

The Chaos and Clues method is a simple flow-chart method without mathematical calculations, facilitating integration in real practice. Consistent with RPA, from which Chaos and Clues was developed, description of the lesion precedes

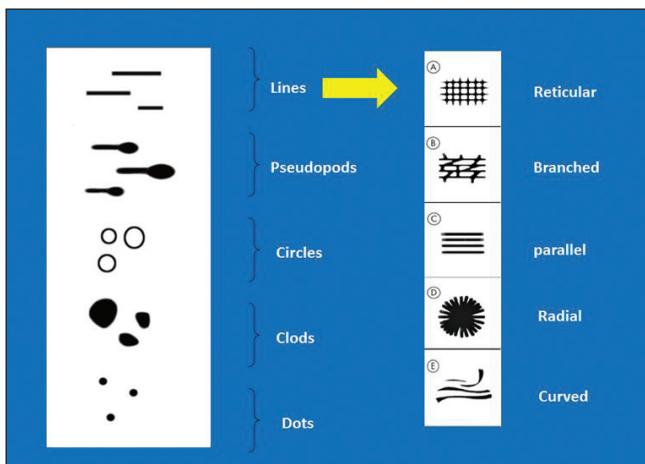


Figure 2. Basic structures.

the diagnosis, the act of describing a lesion assisting the cognitive process. Metaphoric terms with preconceived diagnostic implications are not used, as they require that the diagnosis be known before the name of the structure is selected, a practice which defies logic and is contrary to the method used in every other field of medicine!

A pattern is made up of multiple repetitions of a basic structure—it should cover a significant area (at least 25 to 30 percent of the lesion). If no single structure predominates, the lesion is termed structureless. Structureless areas are not necessarily featureless but no single feature will be dominant.

There are five basic structures (See Figure 2):

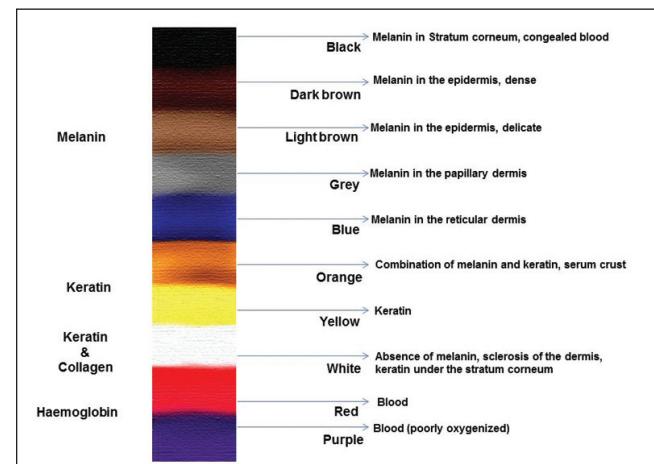


Figure 3. Light scattered back by melanin at various depths.

1. Line: a two dimensional continuous object with length greatly exceeding width
2. Pseudopod: a line with a bulbous end
3. Circle: a curved line equidistant from a central point
4. Clod: any well circumscribed, solid object larger than a dot; clods may take any shape
5. Dot: an object too small to have a discernable shape.

Lines are further classified into five types: Reticular, branched, parallel, radial, and curved, as these have diagnostic significance.

Color is another diagnostic tool when assessing lesions with a dermatoscope. Melanin at the stratum corneum absorbs all light and appears black. Melanin at the dermo-

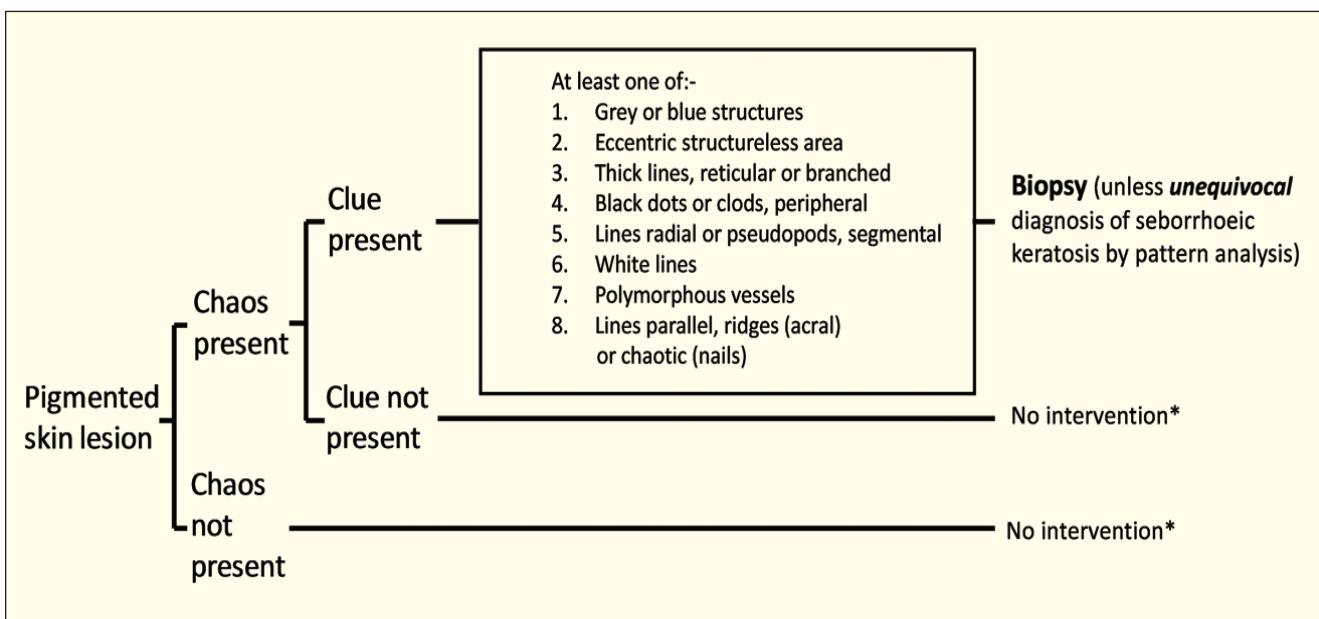


Figure 4. The Chaos and Clues Algorithm

epidermal junction still absorbs all light but some light is reflected back by particles in the epidermis so it appears brown (near-black). Melanin in the superficial dermis still absorbs all light reaching it but light scattered back by collagen causes a minor Tyndall effect so there is a slight shift to blue; it appears grey. Melanin in the deep dermis still absorbs all light reaching it but light scattered back by collagen causes a major Tyndall effect, so it appears blue. See Figure 3.

RECOGNIZING CHAOS

When assessing lesions with a dermatoscope, chaos is defined as asymmetry of structure and/or color, symmetry being based on pattern, not outline.

With experience, lesions can be assessed at scanning speed and there is no need to decide if a lesion is melanocytic. The melanocytic/non-melanocytic is employed in most of the other methods, but the criteria used to define melanocytic status are inconsistent and unreliable so that there are for example many lesions with pigment network which are not melanocytic. Only the dermatopathologist can see melanocytes! Also the aim is to identify every malignancy, not just melanomas. Rather than the first step being "is it melanocytic?" it should be "is it suspicious?" That is the way the Chaos and Clues method is structured.

The Chaos and Clues algorithm is simple. See Figure 4. If there is no chaos, move to the next lesion (Read "Exceptions to the Chaos Rule" sidebar on page xx). If you cannot decide if there is chaos present, manage the lesion as chaotic.

Eliminating non-chaotic lesions increases the prevalence of the condition in the sample investigated, increases the positive predictive value (PPV), and reduces the number of benign lesions at risk of biopsy.

If chaos is found during scan of patient's lesions, stop the exam and look to see if one of the eight clues outlined below is present.

CLUES TO MALIGNANCY

The eight clues to malignancy are as follows.

1. Grey or Blue Structures (See Figures 5 & 6)

The presence of grey colour is a very sensitive clue (most melanomas, even in-situ, have this clue) but it is not as highly specific.

View every chaotic lesion with grey as suspicious but a second clue greatly increases specificity.

Melanin incontinence correlates with dermatoscopic grey dots. Every pigmented melanocytic lesion will con-

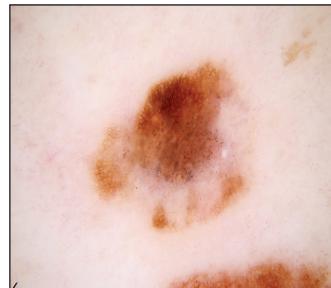


Figure 5

tain some brown colour. It can be used as a reference to identify grey. Pigmented circles on the face are a clue to lentigo maligna. Such circles are commonly grey.

Blue colour usually correlates with pigmented nested cells deep in the dermis, either melanocytes or pigmented basal cell carcinoma cells.

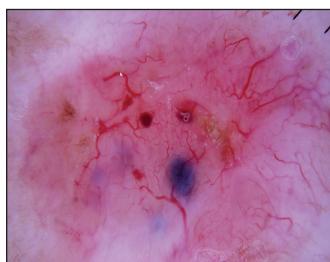


Figure 6

2. Eccentric Structureless Area (See Figure 7)

An eccentric structureless area covering at least 25 percent of the lesion (any color except skin color) is a clue to malignancy.

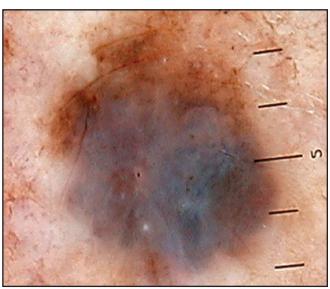


Figure 7

3. Thick Lines Reticular or Branched (See Figure 8)

Lines should be thicker than the holes they surround. This correlates with rete ridges packed full of pigmented malignant melanocytes and due to the chaotic behaviour of malignant tissue, this clue will be present focally. Thick reticular lines are also a clue to seborrheic keratosis but in this case they will be generalised rather than focal and there should be other convincing clues to seborrheic keratosis for that diagnosis to be made.

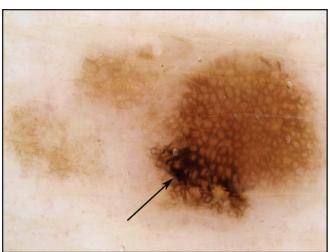


Figure 8

4. Black Dots or Clods, Peripheral (See Figure 9)

Black dots can correlate with pagetoid single melanocytes and black clods correlate with pagetoid nests of pigmented melanocytes. Black can occur centrally in nevi when keratinocytes containing melanin move to the stratum corneum after irritation, but black can occur anywhere in a melanoma. When it is peripheral it is a clue to malignancy.

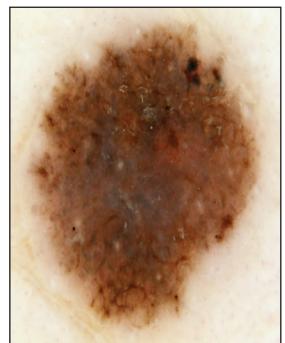


Figure 9

EXCEPTIONS TO THE CHAOS RULE

Exceptions are an untested part of the algorithm aimed at increasing sensitivity from the verified 90.6%. Even in the absence of chaos, the lesions with the following features should be further assessed with careful weighing of all clinical and dermatoscopic clues:

1. Changing lesions on adults, especially with increasing age, with either historic or dermatoscopic evidence of change (peripheral clods, radial lines, or pseudopods)
2. Nodular lesions or very small lesions with any clue to malignancy
3. Any lesion on the head or neck with dermatoscopic grey color
4. Lesions on palms or soles (acral) with a parallel ridge pattern.

5. Lines Radial or Pseudopods, Segmental (See Figure 10)

Segmental radial lines are a clue to malignancy. Circumferential radial lines may occur in benign lesions such as recurrent and Reed nevi. (Partial biopsy of a nevus risks misdiagnosis (a negative diagnosis re melanoma cannot be made on partial biopsy) and is likely to result in a recurrent naevus which may be difficult to assess both for the dermatoscopist and dermatopathologist. We advocate excision of all Spitzoid lesions (Reed and Spitz nevi), in adults and Spitz nevi in children). Radial lines (peripheral segmental and central) are also a clue to pigmented BCC but in BCC they "converge" either to a central point or to a line.

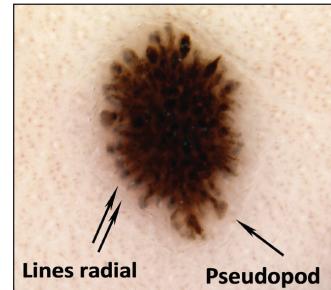


Figure 10

Figure 10 shows a dark, irregular lesion with several radial lines extending from a central dark area. One line is labeled 'Lines radial' and another is labeled 'Pseudopod'.

6. White Lines (See Figure 11)

White lines are a clue to malignancy and polarizing-specific perpendicular white lines are a clue to malignancy (BCC and melanoma) and they also occur in dermatofibroma, Spitz Naevus and pyogenic granuloma.

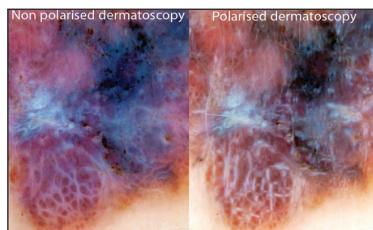


Figure 11

Figure 11 shows two side-by-side dermatoscopic images of a lesion. The left image is 'Non polarised dermatoscopy' and the right image is 'Polarised dermatoscopy'. The polarised image shows distinct white lines.

7. Polymorphous Vessels (See Figure 12)

Pigmented structures should take priority over vessel analysis, but when more than one pattern of vessels is

seen in pigmented lesions which also have chaos, this is a clue to malignancy. In this context, the presence of a pattern of dot vessels is suggestive of melanoma.

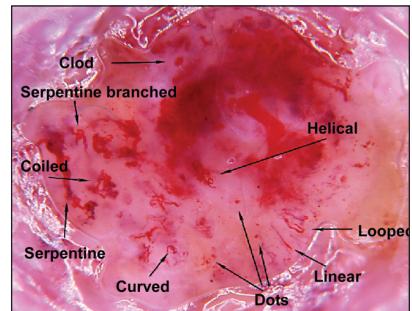


Figure 12

8. Lines Parallel, Ridges (Palms or Soles) or Chaotic (Nails) (See Figures 13 and 14)

The typical dermatoscopic pattern of acral pigmented lesions is parallel lines, with lines that follow the ridges and furrows that create palm and foot prints. Melanin pigment that is concentrated on the broader ridges defined by the eccrine duct openings is a clue to melanoma even in the absence of chaos. Longitudinal nail pigmentation should always lead to a careful examination for clues to subungual melanoma, the clue being that the lines are chaotic: varying in width, interval and colour.



Figure 13

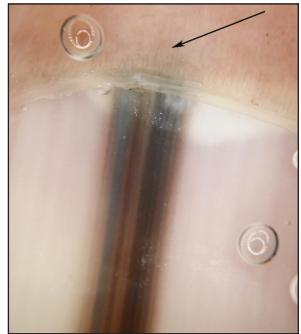


Figure 14

A SIMPLE METHOD

We are not claiming that Chaos and Clues is more sensitive than other methods but it has been evaluated on both melanocytic and non-melanocytic lesions on a test series of pigmented lesions excised with suspicion of malignancy and with predominantly in-situ melanomas. It is simple to use and is adapted for the work-flow of routine practice. It provides a framework on which to build accumulated experience. ■

This article is based on Dr. Rosendahl's presentation at the 2013 Cosmetic Surgery Forum (www.cosmeticsurgeryforum.com)

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For a PDF of the Chaos & Clues poster, requests can be emailed to cliffrosendahl@bigpond.com.

1. Rosendahl C1, Cameron A, McColl I, Wilkinson D. Dermatoscopy in routine practice - 'chaos and clues'. *Aust Fam Physician*. 2012 Jul;41(7):482-487.