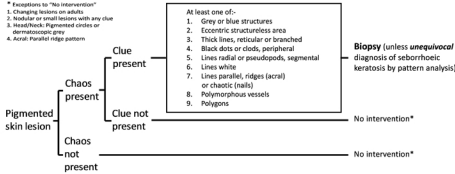


A Dermatoscopic Decision Algorithm for Pigmented Skin Malignancy^{1,2,3}

Cliff Rosendahl¹ Alan Cameron² Philipp Tschandl³ Agata Bulinska⁴ Jean-Yves Gourhant⁵ Jeff Keir⁶ Harald Kittler⁷

Flowchart for the CHAOS & CLUES Algorithm¹



'Chaos' is defined as asymmetry of structure or colour

A 'clue' is one of nine clues to malignancy (in contrast to clues to a specific diagnosis)

A biopsy of a pigmented skin lesion should ideally include the whole lesion

This algorithmic method is a diagnostic tool but no method, including this one, can be guaranteed to detect every malignancy

Revised Pattern Analysis^{1,2,3}

Pattern + Colours + Clues = Diagnosis

A pattern is formed by multiple repetitions of basic structures

- Is there one pattern or more than one pattern?
- Is there one colour or more than one colour?
- Are pattern and colours combined symmetrically or asymmetrically?
- What is the differential diagnosis based on 1-3 above?
- Are there clues to a specific diagnosis?

Basic Structures

Line - reticular (A), branched (B), parallel (C), radial (D) and curved (E); a two-dimensional continuous object with length greatly exceeding width, extending in one direction

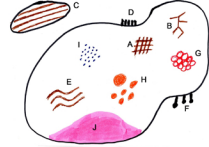
Pseudopod (F): a line with a bulbous end

Circle (G): a curved line equidistant from a central point

Clod (H): any well circumscribed solid object larger than a dot, with any shape

Dot (I): an object too small to have a discernible shape

Structureless (J): an area with none of the basic structures dominating

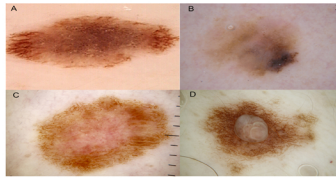


This is a diagrammatic representation of all of the basic structures in revised pattern analysis

Is there CHAOS?

CHAOS is defined as asymmetry of structure or colour. Irregularity of shape does not matter. Perfect symmetry is not expected in nature and is not required. Look at the overall pattern. With experience this can be assessed at scanning speed. There is no need to decide whether the lesion is melanocytic. If CHAOS is not present move to the next lesion. If CHAOS is present **STOP** and **EXAMINE** for one of 9 CLUES to malignancy.

Scan these four lesions for the presence of CHAOS (present in B). Note that D is symmetrical (by pattern and colour), irregularity of shape does not matter.



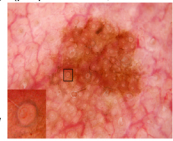
CHAOS

Exceptions

Exceptions are an untested part of the algorithm aimed at increasing sensitivity from the verified 90.6%. We suggest that lesions with the features listed here be further assessed with careful weighing of all clinical and dermatoscopic clues even if not chaotic.

- Changing lesions on adults, especially with increasing age, with either historic or dermatoscopic evidence of change (peripheral clods, radial lines or pseudopods).
- Nodular lesions or very small lesions with any clue to malignancy.
- Head/Neck: Pigmented circles or dermatoscopic grey colour.
- Lesions on palms or soles (acral) with a parallel ridge pattern.

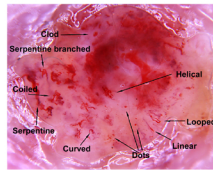
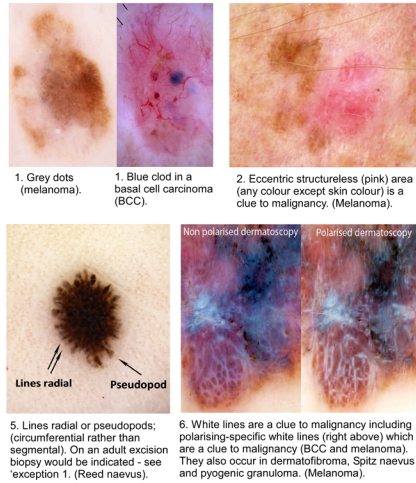
This is an example of a facial lentigo maligna with grey circles but without CHAOS.



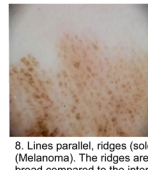
CLUES

Is a CLUE to malignancy present?

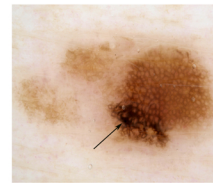
- Grey or Blue Structures
- Eccentric Structureless Area
- Thick Lines Reticular or Branched
- Black Dots or Clods, Peripheral
- Lines Radial or Pseudopods, Segmental
- White Lines
- Polymorphous Vessels⁴
- Lines Parallel, Ridges (Palms or Soles) or Chaotic (Nails)
- Polygons⁵



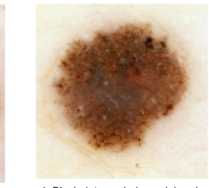
7. Polymorphous vessels; although this BCC is not pigmented it is included here because it displays almost every vessel type.



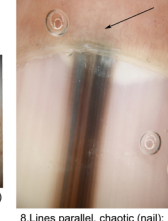
8. Lines parallel, ridges (sole) (Melanoma). The ridges are broad compared to the intervening furrows. Acral melanoma can arise in a furrow-pattern naevus in which case chaos and other clues to malignancy are expected.



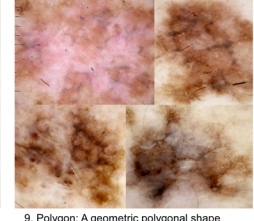
3. Thick lines reticular (arrow). (Melanoma).



4. Black dots or clods, peripheral. (Melanoma).



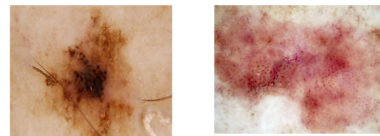
8. Lines parallel, chaotic (nail): varying in width, interval and colour. An arrow marks the location of a melanoma in the nail matrix (thumb) concealed by the proximal nail fold and nail plate.



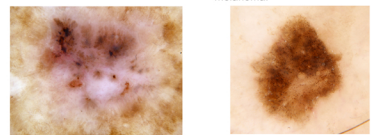
9. Polygon: A geometric polygonal shape complete or incomplete, bounded by straight lines, or by a straight pigment interface, meeting at angles and larger than the holes caused by individual follicles and larger by far than the holes bounded by reticular lines.

Specific Diagnosis of Pigmented Skin Malignancies³

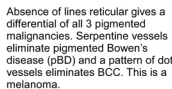
(Not critical because CHAOS & CLUES leads to biopsy anyway)



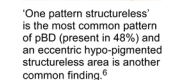
The only malignancy expected to have a pattern of lines reticular is melanoma.



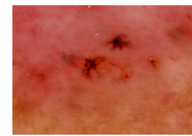
In this BCC the 'lines radial converging' are located peripherally and segmentally and they are thick. This corresponds to the so-called 'leaf-like structures' of metaphorical terminology.



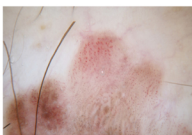
Absence of lines reticular gives a differential of all 3 pigmented malignancies. Serpentine vessels eliminate pigmented Bowen's disease (pBD) and a pattern of dot vessels eliminates BCC. This is a melanoma.



'One pattern structureless' is the most common pattern of pBD (present in 48%) and an eccentric hypo-pigmented structureless area is another common finding.⁵



Lines radial, located centrally within a lesion and converging, are specific for BCC. They correspond to the so-called 'spoke-wheel structures' of metaphorical terminology.



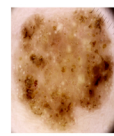
Dots, either pigmented or as coiled vessels, arranged in lines, especially at the periphery, are a common feature of pBD (present in 21%).⁶

Exclusion of Seborrheic Keratoses by Pattern Analysis

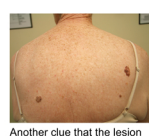
Clues to Seborrheic Keratosis (SK)

- Multiple orange clods
- Multiple white clods
- Sharply demarcated border over total periphery
- Multiple grouped similar lesions

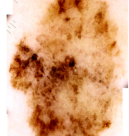
Remember: malignant lesions may have orange and white clods and melanomas may be located among grouped seborrheic keratoses. Weigh the clues. If clues to malignancy are present and the diagnosis of seborrheic keratosis is equivocal, perform a biopsy!



Seborrheic keratosis



Another clue that the lesion on the right was a melanoma was the clinical clue of a flat smooth contour - unlike the rough texture of the SK



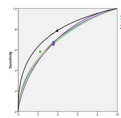
Invasive melanoma

Evaluation of CHAOS & CLUES

Assessment of 463 consecutive pigmented lesions - Dermatoscopy and Clinical diagnostic accuracy⁷

Cliff Rosendahl, Alan Cameron, Philipp Tschandl, Harald Kittler

Sensitivity (any malignancy): 90.6%
Specificity: 62.7%
If chaos and clues point to malignancy but seborrheic keratosis/solar lentiginous-like-keratosis (LPLK) can be diagnosed with confidence by pattern analysis:
Sensitivity (any malignancy): 90.6%
Specificity: 74.4%



ROC Threshold

Assessment of 128 consecutive melanocytic lesions by 3 dermatologists comparing 3 point system, 7 point checklist, ABCD method, Menzies method and Chaos & Clues⁸

Philipp Tschandl, Alan Cameron, Cliff Rosendahl, Harald Kittler

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Any method can miss malignancies. We recommend that this poster should be studied in conjunction with references [1&3].

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