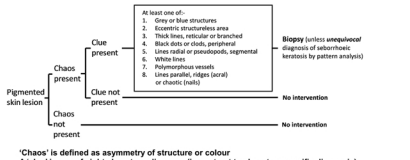
CHAOS & CLUES

A Dermatoscopic Decision Algorithm for Pigmented Skin Malignancy[1,2,3]

Cliff Rosendahl[a] Alan Cameron[a] Philipp Tschandl[b] Agata Bulinska[a] Jean-Yves Gourhant[c] Harald Kittler[b]

Flowchart for the CHAOS & CLUES Algorithm[1]



'Chaos' is defined as asymmetry of structure or colour
A 'clue' is one of eight 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

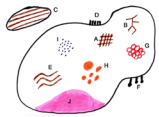
Revised Pattern Analysis[1,2,3]

Pattern + Colours + Clues = Diagnosis

A pattern is formed by multiple repetitions of basic structures

1. Is there one pattern or more than one pattern?
2. Is there one colour or more than one colour?
3. Are pattern and colours combined symmetrically or asymmetrically?
4. What is the differential diagnosis based on 1-3 above?
5. 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



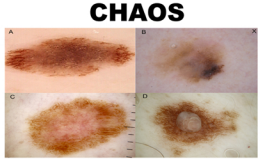
This is a diagrammatic representation of all of the basic structures in revised pattern analysis

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 8 **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.

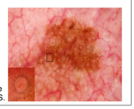
CHAOS



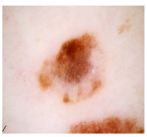
Exceptions

Exceptions are an untested part of the algorithm aimed at increasing sensitivity from the verified 90.6%[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.*

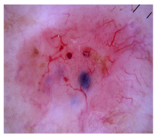
1. Changing lesions on adults, especially with increasing age, with either historic or dermatoscopic evidence of change (peripheral clods, radial lines or pseudopods).
2. Nodular lesions or very small lesions with any clue to malignancy.
3. Any lesion on the head or neck with dermatoscopic grey colour.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



This is an example of a facial lentigo maligna with the CLUE of 'grey structures' (circles) but without CHAOS.



1. Grey dots (melanoma).

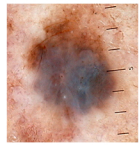


1. Grey or blue structures in a basal cell carcinoma (BCC).

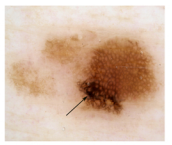
CLUES

Is a CLUE to malignancy present?

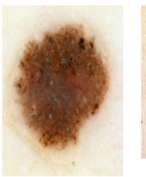
1. Grey or Blue Structures
2. Eccentric Structureless Area
3. Thick Lines Reticular or Branched
4. Black Dots or Clods, Peripheral
5. Lines Radial or Pseudopods, Segmental
6. White Lines
7. Polymorphous Vessels[4]
8. Lines Parallel, Ridges (Palms or Soles) or Chaotic (Nails)



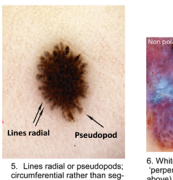
2. Eccentric structureless (blue) area (any colour except skin colour is a clue to malignancy) (Melanoma).



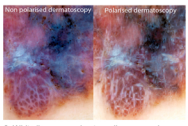
3. Thick lines reticular (arrow) (Melanoma).



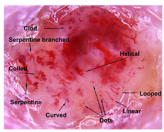
4. Black dots or clods, peripheral (Melanoma).



5. Lines radial or pseudopods; circumferential rather than segmental. On an adult excision biopsy would be indicated - see 'exception 1' (Reed naevus).

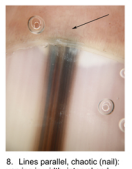


6. White lines are a clue to malignancy and 'perpendicular white lines polarising-specific' (right above) are a clue to malignancy (BCC and melanoma) and they also occur in dermatofibroma, Spitz naevus and pyogenic granuloma. This is an invasive melanoma.



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

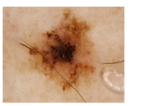
8. Lines parallel, ridges (sole) (Melanoma). The ridges are broad compared to the intervening furrows. Acral melanoma can arise in a furrow-pattern naevus in which case chaos and other clues to malignancy are expected.



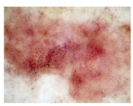
8. Lines parallel, chaotic (nail): varying in width, interval and colour. An arrow marks the location of a melanoma in the nail matrix (thumb) concealed by the proximal nail fold and nail plate.

Specific Diagnosis of Pigmented Skin Malignancies[3]

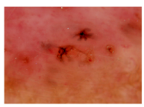
(Not critical because CHAOS & CLUES leads to biopsy anyway)



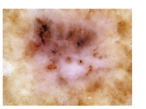
With very few exceptions the only malignancy with lines reticular is melanoma.



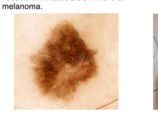
Absence of lines reticular gives a differential of all 3 pigmented malignancies. Serpentine vessels eliminate pigmented Bowen's disease (pBD) and a pattern of dot vessels eliminates BCC. This is a melanoma.



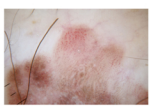
Lines radial, located centrally within a lesion and converging, are specific for BCC. They correspond to the so-called 'spoke-wheel structures' of metaphorical terminology.



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.



'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]



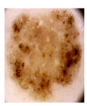
Dots, either pigmented or as coiled vessels, arranged in lines, especially at the periphery, are a common feature of pBD (present in 21%).[5]

Exclusion of Seborrhoeic Keratoses by Pattern Analysis

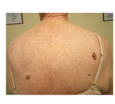
Clues to Seborrhoeic Keratosis

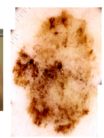
1. Multiple orange clods
2. Multiple white clods
3. Thick curved lines
4. Sharply demarcated border over total periphery
5. Multiple grouped similar lesions

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



Seborrhoeic keratosis





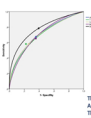
Invasive melanoma

Evaluation of CHAOS & CLUES

Assessment of 463 consecutive pigmented lesions – Dermatoscopy and Clinical diagnostic accuracy[6]
Cliff Rosendahl, Alan Cameron, Philipp Tschandl, Harald Kittler

Sensitivity (any malignancy): 90.6%
Specificity: 62.7%
If chaos and clues point to malignancy but seborrhoeic keratosis/solar lentigo/lichen-planus-like-keratosis (LPLK) can be diagnosed with confidence by pattern analysis:
Sensitivity (any malignancy): 90.6%
Specificity: 77.4%

Assessment of 128 consecutive melanocytic lesions by 3 dermatoscopists comparing 3 point system, 7 point checklist, ABCD method, Menzies method and Chaos & Clues[7]
Philipp Tschandl, Alan Cameron, Cliff Rosendahl, Harald Kittler



The 95%-Confidence Intervals of the AUC of all 5 Algorithms overlap. Therefore all algorithms, including the new short pattern analysis, are considered equal in diagnostic accuracy.

Affiliations

(a) School of Medicine, The University of Queensland, Australia
(b) Department of Dermatology and Venereology, Medical University of Vienna, Austria
(c) Centre de Dermatologie, Nemours, France

Any method can miss malignancies. We recommend that this poster should be studied in conjunction with references [1&3].
Electronic format (PDF) requests for this poster: cliffrosendahl@bigpond.com

References

1. Rosendahl C, Cameron A, McColl I, Wilkinson D. Dermatoscopy in routine practice - Chaos and Clues. Aust. Fam. Physician. 2012 Jul;41(7):482–7.
2. Kittler H. Dermatoscopy: Introduction of a new algorithmic method based on pattern analysis for diagnosis of pigmented skin lesions. Dermatopathology: Practical & Conceptual. 2007 13. 1.
3. Kittler H, Rosendahl C, Cameron A, Tschandl P. Dermatoscopy 2011. Facultas.wuv Austria.
4. Kittler H, Ried E, Rosendahl C, Cameron A. Dermatoscopy of unpigmented lesions of the skin: a new classification of vessel morphology based on pattern analysis. Dermatopathology: Practical & Conceptual. 2008 14.4.
5. Cameron A, Rosendahl C, Tschandl P, Riedl E, Kittler H. Dermatoscopy of pigmented Bowen's disease: J Am Acad Dermatol.2010. April; 62(4): 597-604.
6. Rosendahl C, Tschandl P, Cameron A, Kittler H. Diagnostic accuracy of dermatoscopy for melanocytic and nonmelanocytic pigmented lesions. J. Am. Acad. Dermatol. 2011 Jun;64(6):1068–73.
7. Tschandl P, Cameron A, Rosendahl C, Kittler H. Presented at the 2nd International Congress of the International Dermoscopy Society, Barcelona, Spain, November 2009.

13-8-2013

PREDICTION without PIGMENT

A Decision Algorithm for Non-Pigmented Skin Malignancy

Cliff Rosendahl[1], Alan Cameron[1], Agata Bulinska[1], Philipp Tschandl[2], Harald Kittler[2]

1. School of Medicine, The University of Queensland, Australia
2. Department of Dermatology and Venereology, Medical University of Vienna, Austria

The method presented here is a diagnostic tool, but no method, including this one, can be guaranteed to detect every malignancy
In particular, any Elevated, Firm, Growing (EFG) lesion should be excised[1]

Clues to Diagnosis

Although non-pigmented skin lesions lack clues of melanin structures, there are other useful non-vessel clinical and dermatoscopic clues that take priority.

Ulceration without a history of trauma should be regarded as a clue to malignancy. It is commonly present in BCC and even when not evident clinically it may often be identified by the presence of adherent fibre observed dermatoscopically.[2]

White clues* include dermatoscopic white lines as well as (in the case of raised lesions only) clues produced by keratin both on the surface of the skin (evident as scale) and beneath the stratum corneum where it appears in the form of dermatoscopic white circles and white structureless areas.[3] *For this purpose white clues do not include white dots or clods (so-called 'milia-like cysts') which can occur in malignant conditions but which are also common in seborrhoeic keratoses.*
Dermatoscopic white lines of any type, including perpendicular white lines (polarising-specific) are a clue to malignancy. Perpendicular white lines seen with polarised dermatoscopy are a published clue to BCC and melanoma as well as to the benign conditions Spitz naevus, DF, LPLK and scar tissue.[4] The authors have also seen them in IEC and PG. White lines seen with non-polarising dermatoscopy can be a clue to both melanoma and BCC[2] but they also are not specific to malignancy.
In raised lesions, the keratin clues of dermatoscopic white circles, dermatoscopic white structureless areas and surface keratin are clues to SCC and KA.[3]
For the purpose of this algorithm a **raised lesion** is one with a significant visibly or palpably raised contour or with the dermatoscopic clue to a raised lesion of looped vessels.

Vessel type can be as dots, clods, linear, looped, curved, serpentine, helical or coiled and **vessel arrangement** can be random (non-specific), clustered, serpiginous, linear, centred, radial, reticular or branched.[2] A **monomorphous** vessel pattern consists of vessels of a single type sufficient to form a pattern. If there is more than a single vessel pattern or if more than one vessel type is present in significant quantities throughout the lesion in a speckled distribution the pattern is termed **polymorphous**.[5]

References

1. Chamberlain AJ, Fritschi L, Kelly JW. Nodular melanoma: patients' perceptions of presenting features and implications for earlier detection. J Am Dermatol 2003; 48:694-701.
2. Kittler H, Rosendahl C, Cameron A, Tschandl P. Dermatoscopy www.Facultas pages 179-193.
3. Rosendahl C, Cameron A, Argenziano G, Zalaudek I, Tschandl P, Kittler H. Dermoscopy of squamous cell carcinoma and keratoacanthoma. Arch Dermatol. 2012 Dec 1;148(12):1386-92.
4. Balagula Y, Braun RP, Rabinovitz HS, Dusza SW, Scope A, Liebman TN, et al. The significance of crystalline/chrysalis structures in the diagnosis of melanocytic and nonmelanocytic lesions. J. Am. Acad. Dermatol. 2012 Aug;67(2):194.e1-8.
5. Kittler H, Riedl E, Rosendahl C, Cameron A. Dermatoscopy of unpigmented lesions of the skin: a new classification of vessel morphology based on pattern analysis. Dermatopathology: Practical & Conceptual 14, no. 4 (December 2008).

Abbreviations

BCC - Basal cell carcinoma
SCC - Squamous cell carcinoma
SK- Seborrhoeic keratosis
DF - Dermatofibroma
KA - Keratoacanthoma
IEC - Intra-epidermal carcinoma (Bowen's disease or SCC in-situ)
LPLK - Lichen planus like keratosis
CCA - Clear cell acanthoma
PG - Pyogenic granuloma

If you cannot make a confident clinical diagnosis of solar or seborrhoeic keratosis, viral wart, dermal naevus or benign cyst then apply this algorithm:-

Prediction without Pigment - short version

- Non-pigmented lesion
  - Ulceration or white clues* present — **Consider Biopsy (exclude malignancy)**
  - Ulceration or white clues* not present — **Apply vessel pattern analysis[2] (see below)**
    A polymorphous pattern including dots is strongly suspicious for melanoma
    A clods-only pattern, and in raised lesions a centred or serpiginous pattern, should be benign. All other patterns must be assessed for malignancy.

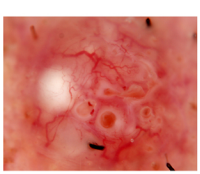
A **clods-only pattern** must have no vessels within the (red/purple) clods. A centred pattern must have vessels centred in **skin-coloured** clods.

Prediction without Pigment - full version

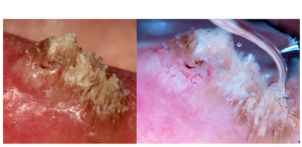
- Non-pigmented lesion
  - Ulceration or white clues* present — **Consider Biopsy (exclude malignancy)**
    Ulceration: BCC, SCC, Melanoma
    White clues (lines): BCC, Melanoma, Spitz naevus, DF, LPLK, PG
    White clues (other): SCC/KA
  - Ulceration or white clues* not present
    - Flat
      - Polymorphous vessels
        - Vessels as dots present — **Biopsy (exclude melanoma)**
        - Vessels as dots not present — BCC, IEC, SK, LPLK
      - Monomorphous vessels
        - Dots, serpentine or coiled — **Dots**: Melanocytic naevus, IEC, viral wart, inflammation/psoriasis
          Serpentine: BCC, scar
          Coiled: IEC, SK
        - Clods (red/purple) — **Clods: Haemangioma**
          (There must be no vessels within clods)
    - Raised
      - Vessel arrangement non-specific (random) (includes no vessels seen)
        - Not only clods — Melanoma
          BCC, SCC/KA, SK, PG
        - Only clods(red/purple) — **Haemangioma, haemorrhage**
          (There must be no vessels within clods)
      - Vessel arrangement specific
        - Radial or branched — **Radial**: KA/SCC, BCC with ulceration, sebaceous gland hyperplasia, molluscum
          Branched: BCC, SCC/KA, Merkel cell carcinoma, any raised cyst or neoplasm
        - Serpiginous or centred — **Serpiginous: CCA**
          Centred: SK, viral wart, dermal naevus

(A centred pattern must be in **SKIN-COLOURED** clods)

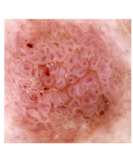
(Other specific vessel arrangements (clustered, linear and reticular) are not commonly encountered in a raised lesion and if present should be assessed as 'non-specific' for the purpose of this flowchart).



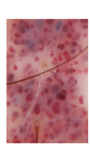
'White clues' (white circles in a raised lesion) are present so a decision to biopsy can be made without vessel pattern analysis. This is a dermatoscopic image of an SCC.



Clinical (left) and dermatoscopy (right) images of this lesion on an ear reveal that it is raised with 'white clues' of surface keratin and a white structureless area. It is an SCC.



Ulceration or 'white clues' are not present. Vessel pattern analysis reveals a centred vessel pattern (the vessels must be centred in **skin-coloured** clods) consistent with a benign diagnosis. This is a seborrhoeic keratosis.



There is no ulceration and no 'white clues'. The vessel pattern is **(red/purple)** clods-only consistent with the benign diagnosis of haemangioma. This pattern must not have any vessels within the clods to be interpreted as benign.

23-7-2013