SHORT REPORT

Rosettes and other white shiny structures in polarized dermoscopy: histological correlate and optical explanation

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Abstract

Background Rosettes are a specific form of a white shiny structure seen with polarized dermoscopy. The precise morphological correlate and optical explication are not known.

Objective To estimate the frequency of rosettes in *ex vivo* dermoscopy and to find explication and morphologic correlate of this dermoscopic feature.

Methods A series of 6108 consecutive skin biopsies were examined with *ex vivo* dermoscopy and when rosettes were present serial transverse sections with polarization were examined.

Results In this series of 6108 consecutive skin biopsies, rosettes were found on *ex vivo* dermoscopy in 63 cases. When multiple we observed that they are always oriented at the same angle. Transverse sections with polarization of these lesions proved that smaller rosettes are mainly caused by polarizing horny material in adnexal openings, and larger rosettes by concentric perifollicular fibrosis.

Conclusions Rosettes are an optical effect of crossed polarization by concentric fibrosis or horny material and hence are not lesion-specific.

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Conflicts of interest

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Rosettes are peculiar structures only observed with polarized dermoscopy. They are defined as four white points, arranged as a four leaf clover.[1] Since recently the term 'four-clod dots' is used for these structures. First believed to be specific for actinic keratosis and squamous cell carcinoma, they are not lesion-specific and are described in many lesions.[2] They are a form of so-called white shiny structures, as are white shiny lines and white shiny areas.[3] In contrast to shiny lines and areas, that are probably caused by fibrotic dermal changes,[3–7] the exact tissue correlate of rosettes is unknown. Interaction of the polarized light with narrowed or keratin filled adnexal openings has been suggested as the morphological correlate.[2] Others suggested that rosettes correspond to an alternating focal hyperkeratosis and normal corneal layer and keratin filled openings.[8]

Table 1 Lesions with rosettes on *ex vivo* dermoscopy in a series of 6108 consecutive skin biopsies

BCC	17/988 (1.7%)
SCC	12/291 (4.0%)
DF	7/116 (6.0%
Naevus	14/1880 (0.7%)
Melanoma	2/135 (1.4%)
Scar	2/31 (6.4%)
Cyste	2/359 (0.5%)
Inflammatory	5
Molluscum	1/17 (5.9%)
Dilated pore	1/2 (50%)
Total	63/6108 (1.0%)

BCC, basal cell carcinoma; SCC, squamous cell carcinoma; DF, dermatofibroma.

Liebman found white shiny structures (crystalline structures) in 38.7% of a series of 538 retrospectively examined *in vivo* cases[2] of melanoma, basal cell carcinoma, squamous cell carcinoma, actinic keratosis and lichen planus-like keratosis. In a comparative study of 102 consecutive tumoral skin lesions seen by one dermatologist, we found crystalline structures in 42.3% of the *ex vivo* dermoscopy images compared to 34.7% of the *in vivo* images. In *ex vivo* setting white structures are more apparent than on the *in vivo* image.[9]

Since we routinely use *ex vivo* dermoscopy with polarized light as part of the macroscopic examination of skin biopsies, we regularly observe rosettes. They vary in diameter from 0.20 to 0.5 mm. Liebman *et al.*[3] found that rosettes were significantly more likely to be observed in actinic tumours than other lesions. In her study Liebman found rosettes in 46.3% of actinic keratosis. This was confirmed by Lee who found rosettes in 38.2% of actinic keratosis.[10] We found in 63 (1%) cases rosettes on our *ex vivo* image in a series of 6108 consecutive skin biopsies received at the same dermatopathology lab (Table 1). We noticed them mainly in basal cell carcinomas and, squamous cell carcinoma. We also saw them in naevi, and melanomas. Furthermore, we also found them in dermatofibromas and recently we saw multiple rosettes in a punch biopsy taken for an urticarial dermatitis, in a scar and for cicatricial alopecia of lichen planopilaris type. This confirms that rosettes are not lesion specific and can be seen in various cutaneous lesions, even in inflammatory diseases. In lesions resected on actinic damaged skin many of the observed rosettes were seen in the non-lesional part of the skin.

While observing these structures, when multiple, we noticed that the rosettes were always oriented at the same angle (Fig. 1).

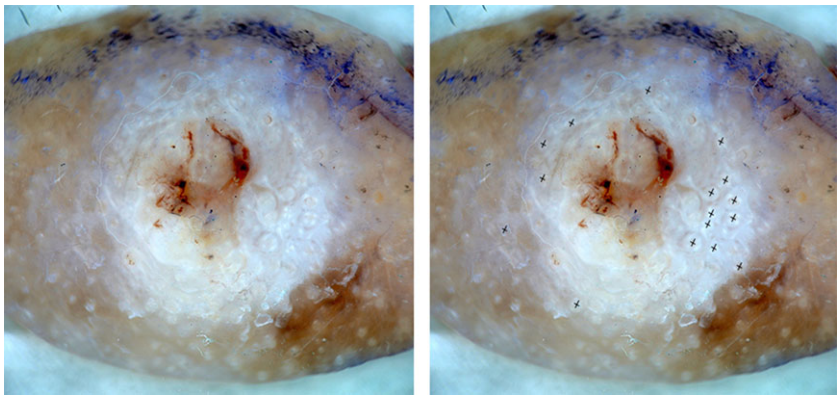

Figure 1 Basal cell carcinoma with numerous rosettes all oriented at same angle (*ex vivo* polarized dermoscopy image).

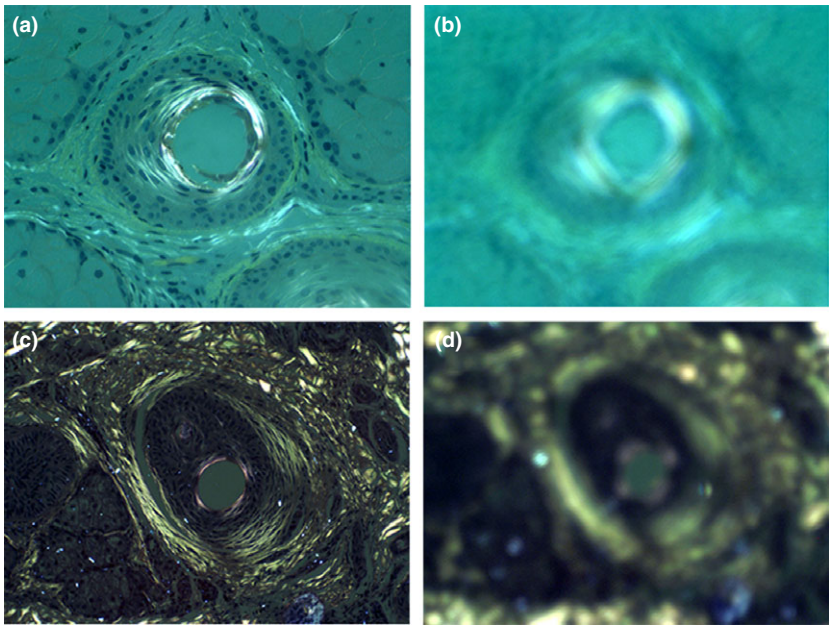

Figure 2 Transverse cuts with crossed polarization of infundibular keratin layer resulting in four-segmented concentric structure (a), acquiring features similar to a rosette when seen out of focus (b). Intrafollicular concentric keratin and outer perifollicular fibrosis (c) creating double rosette when seen out of focus (d).

The angle is preserved for all rosettes visualized by the same dermoscope, even in different lesions and in different patients. The orientation is retained when rotating the dermoscope around an axis perpendicular to the skin surface. The observation of these very regular and symmetric structures, reminded us of the so-called 'Maltese crosses' (birefringent crystals with a symmetrical black cross), caused by polarization of starch crystals. It is well known that they are caused by conoscopic interference, an optical phenomenon occurring when using crossed polarization.[11] Crossed polarized light is produced when a polarizer and an analyser are inserted in the optical path at right angles to each other. Most standard microscopies are equipped with these polarization filters.

Many authors searched for the morphologic correlate of this phenomenon by comparing the dermoscopy with corresponding horizontal sections obtained with *in vivo* reflectance confocal microscopy.[8] We thought that transverse histological sections might help us better to identify these rosettes. In transverse sections through the residual material of these cases we could observe a similar optical effect. We saw a polarizing four-segmented concentric structure, always with the same orientation of the two axes. The smaller structures (0.1–0.2 mm) were caused by polarization of concentric horn material in follicular and even in some eccrine ducts at the infundibular level of the biopsy (Fig. 2a,b). The larger rosettes (0.3–0.5 mm) were caused by concentric fibrosis around the follicles. Bringing the slide out of focus under the microscope created a picture very similar to the rosettes observed in dermoscopy. This convinced us that we were actually looking at the same optic phenomenon. In some cases, we could even find a double rosette: an inner rosette by circular follicular horny material, an outer rosette by perifollicular concentric fibrosis (Fig. 2c,d). Using the same methodology we could also demonstrate that white shiny streaks are indeed mainly caused by polarization of thickened hyaline fibrous bundles. In many dermatofibromas with a stellar aspect on dermoscopy these radial shiny lines are easily identified as polarizing hyaline fibrous bands on transverse cuts.

In conclusion, we describe rosettes and white shiny streaks in *ex vivo* dermoscopy. Rosettes are an optical effect of crossed polarization (so-called Maltese cross) that can be observed in many tumoral and also inflammatory skin lesions and hence are not lesion specific. They are commonly seen in actinic skin. Transverse sections prove that smaller rosettes are mainly caused by polarizing horny material at infundibular level in adnexal openings and larger rosettes mainly by concentric perifollicular fibrosis. As already suggested by others white shiny streaks correspond to polarization of fibrotic changes in the dermis.

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