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Literature Review

Dermoscopic Examination in *Malassezia folliculitis*

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ABSTRACT

Background: *Malassezia folliculitis* (MF) is the most common fungal folliculitis, and it is caused by yeast of the genus *Malassezia*. MF may be difficult to be distinguished clinically from acne and other types of folliculitis, causing misdiagnosis and improper treatment. Dermoscopy has been very useful to support the diagnosis of several types of folliculitis, including MF. **Purpose:** To know the role of dermoscopic examination in MF. **Review**: The diagnosis of MF can be identified by usual clinical presentation with direct microscopy and culture of the specimen, Wood's light examination, histopathological examination, and rapid efficacy of oral antifungal treatments. Several studies reported that dermoscopy provides a deeper level of the image that links the clinical morphology and the underlying histopathology. Some dermoscopic patterns are observed consistently with certain diseases, including MF, so these could be used for establishing their diagnosis. The dermoscopic features of MF seem to correlate with the current understanding of its etiopathogenesis. **Conclusion**: Dermoscopic examination in MF will reveal dermoscopic patterns including folliculocentric papule and pustules with surrounding erythema, dirty white perilesional scales, coiled/looped hairs with perifollicular erythema and scaling, hypopigmentation of involved hair follicles, and dotted vessels.

Keywords: *malassezia folliculitis*, *diagnosis*, *dermoscopy, tropical disease.*

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BACKGROUND

Folliculitis is an inflammatory disorder involving the superficial or deep portion of the hair follicles. Causes of folliculitis are bacterial, viral, parasitic, or fungal infections and other non-infectious causes.[1] *Malassezia folliculitis* (MF) is the most common type of fungal folliculitis caused by *Malassezia* yeasts, located in the sebaceous glands.[2,3] MF can be clinically challenging to be distinguished from acne and other types of folliculitis. This potentially leads to misdiagnosis and improper treatment.[1]

The diagnosis of MF can be identified by usual clinical presentation, which should include direct microscopy and culture of the specimen, Wood's lamp examination, histopathological examination, and confirmed by rapid efficacy of oral antifungal treatments.[4,5] Its typical clinical features are numerous dome-shaped erythematous papules or pustules, 2–3 mm in size, usually pruritic, and distributed over the neck, chest, back (middle part), the extensor side of the upper arm, and rarely present on the face.[6] Microscopic examination, especially potassium hydroxide (KOH) staining, is routinely performed to diagnose MF in a dermatology practice, but further analysis using histopathological examination or culture is sometimes needed in cases with unclear results.[2,3] Study in China by Liu et al. revealed that the sensitivity and specificity of KOH stain were 60.6% and 89.4%, respectively. Due to insufficient color contrast and observer's skills, false-negative results could occur on KOH examination.[7]

Dermoscopy, as a non-invasive auxiliary tool, has also been shown to be helpful in assisting in the diagnosis of several nontumoral skin conditions, including some forms of folliculitis. Dermoscopic examination has recently been used to support the diagnosis of MF, but the diagnostic accuracy has not been well studied.[6,8] Jakhar et al. proposed several

dermoscopic features that could be found in MF lesions without diagnostic accuracy, while Durdu et al. reported that peripheral, regularly distributed dotted vessels in the absence of other diagnostic findings were the main dermoscopic clues of MF with the calculated sensitivity and specificity of 93.1% and 67.3%.[8] Those values seem to be greater than the sensitivity and specificity values of KOH examination reported by Liu et al. It presents an opportunity for dermoscopy as a modality in establishing the diagnosis of MF.[6–8]

REVIEW

Malassezia folliculitis, formerly known as *Pityrosporum folliculitis*, is a fungal acneiform condition caused by the genus *Malassezia*.[2,9] It was first described by Weary et al. in 1969 and recognized by Potter in 1973 as a specific disease that is not rare. However, it easily unrecognized and is not uncommonly misdiagnosed as acne, folliculitis, or eczema.[4] That disease is classified according to International Classification of Diseases, Ninth Revision (ICD-9) with codes 704.8 (folliculitis) and/or 111.0 (infection by *Pityrosporum*), and ICD-10 codes L73.9 (folliculitis) and/or B36.0 (infection by *Pityrosporum*).[10]

The exact pathogenesis of MF is not completely understood.[11] Yeasts of the genus *Malassezia* are lipophilic fungi that are part of the normal flora of human skin in 75%–98% of healthy people. However, under certain circumstances, it can overgrow and lead to an inflammatory reaction in the skin.[12] Higher rates of *Malassezia* skin infections are observed in tropical climates due to the combination of a humid and warm climate. Furthermore, a higher incidence is also observed in those at peak sebum production (adolescence to young adulthood) and more commonly reported in males than in females, with an estimated prevalence of 2.5% to 16%. The risk factor for MF includes immunosuppression, the recent use of broad-spectrum antibiotics and corticosteroid.[13,14] Prindaville et al. reported MF incidence rate of 4.6% in the United States, Durdu et al. reported 4% in Turkey, and Jacinto-Jamora et al. reported 16% in the Philippines.[2,10,15] Retrospective study in Surabaya in the year 2011-2013 by Rosida and Ervianti and 2014-2017 by Primasari and Ervianti reported the increase in MF incidence from 8,01% to 22.4% among the patients attending the mycology division of dermatology clinic, with an average age in the range of 15–24 years old, and the majority of patients were male.[16,17]

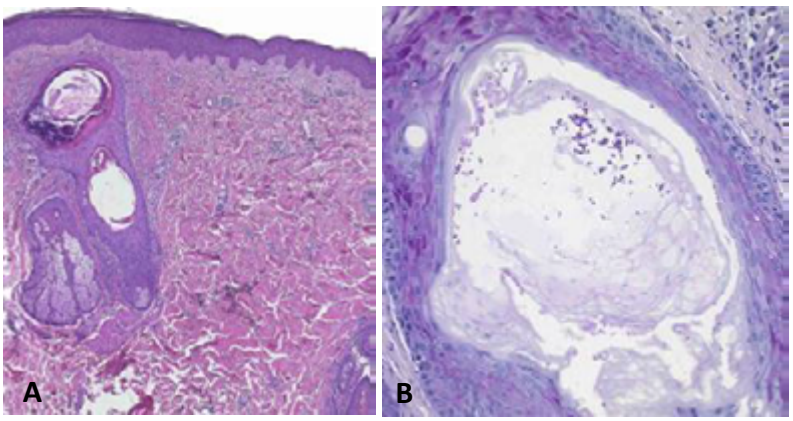


Figure 1. Histopathology of *Malassezia* folliculitis. A. Dilated hair follicle filled with keratinous material and basophilic debris. Shown is a perifollicular inflammatory cell infiltrate with hematoxylin-eosin staining (original magnification, 40x); B. Detail of a serial section of the same follicle demonstrating numerous yeast spores within the dilated follicle lumen. PAS staining was used (original magnification, 200x).[11]

The inflammatory component of MF has many possible mechanisms. *Malassezia* relies upon hydrolysis of their human host sebum triglycerides as they lack a fatty acid synthase to allow endogenous production of C14-C16 saturated fatty acids. The free fatty acids produced are believed to provoke inflammation in the skin of the host. One possibility is *Malassezia*'s in vitro ability to induce keratinocyte production of inflammatory cytokines via Toll-like receptor 2 (TLR 2). Other possible mechanisms leading to inflammation include damage to the epithelial barrier function due to lipase and phospholipase activity of *Malassezia*, sensitization to cross-reactive allergens produced by *Malassezia*, and an irritant, non-immunogenic stimulation of the immune system.[4,13] Biopsy specimens from MF patients typically show dilated follicles plugged with keratinous material, amorphous cellular debris, and inflammatory cells. The follicle contains numerous round yeast forms and demonstrates positivity with PAS stain (Figure 1).[4,11]

MF is an acne-like eruption without comedones. Moderate itching is common in MF, and it is

characterized clinically by symmetrical monomorphic dome-shaped erythematous papules or pustules 2–3 mm in size that presents mainly on the "sebaceous" areas of the trunk (shoulders, chest, and middle part of the back), upper arms, neck and rarely the face. The number of lesions can vary from few to more than one hundred (Figure 2).[3,11,18,19] Although different species may be involved, all species have the same clinical presentation. Clinically, MF is difficult to distinguish from bacterial folliculitis and acne vulgaris. Therefore, it may be treated with topical and/or systemic antibiotics for months or even years.[2] Exceptionally, in infants, it is typically described as 1–2 mm pruritic, monomorphic, pink papules, and pustules (Figure 2). The occurrence of *Malassezia folliculitis* at the age of two months confirms the colonization of the human skin by *Malassezia* yeasts in a few weeks after the birth.[19]

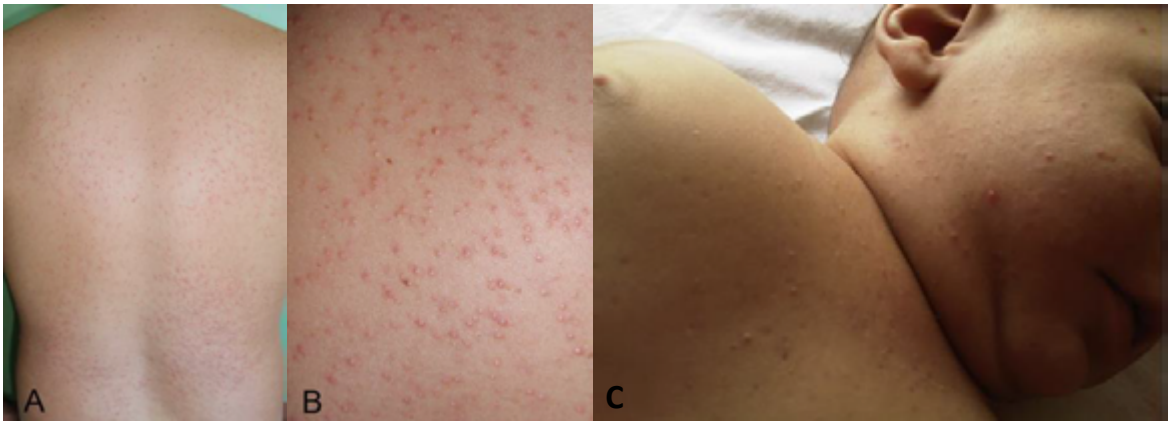


Figure 2. Clinical appearance of *Malassezia* folliculitis. A. Back of the 34-year-old construction worker. The condition developed after working in a hot, humid environment for a few days; B. Close-up view of the lesions in figure A; C. *Malassezia* folliculitis in an infant.[11,19]

The diagnosis of MF is traditionally made based on usual clinical findings verified by positive fungal microscopy and a positive response to antifungal therapy per the clinical guidelines.[3] Direct microscopy and culture have traditionally been the mainstays in laboratory diagnostics in dermatologic practice and are still considered to be the gold standard. Direct microscopical examination by 10%–20% KOH of pustules and follicular hairs can be used to confirm the diagnosis of MF, where an examination reveals abundant round spores budding yeast cells which supports the diagnosis (Figure 3).[5,19] Jacinto-Jamora et al. graded the spore load per high-power field as shown in Table 1. Suzuki et al. stated that MF was diagnosed when 10 or more yeast organisms per follicle (≥10 per visual field at 400 × magnification) were observed under direct microscopic examination.[15,18]

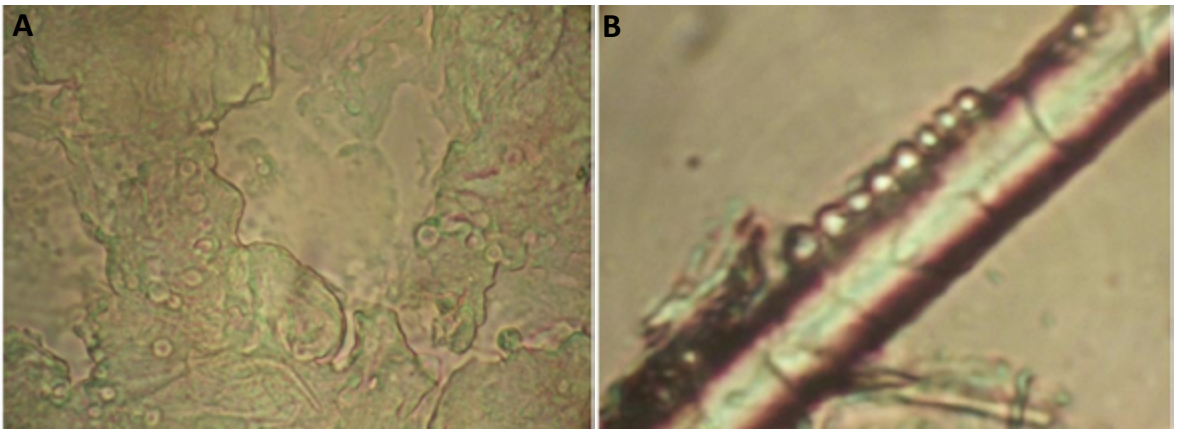


Figure 3. The result of the KOH examination. A. Abundant Malassezia yeast cells in follicular hair; B. Scotch tape: many *Malassezia* yeast cells surrounding hair.[19]

Table 1. Spore load grading system per high-power field by Jacinto-Jamora et al.[15]

Grade	Spore load	Interpretation
+1	1 to 2 single spores, no clusters	Mildly suggestive of MF
+2	Small clusters of not more than 6 spores; if dispersed, 12 spores	Highly suggestive of MF
+3	larger clusters of 7 to 12 spores; if dispersed, 20 spores	Highly suggestive of MF
+4	clusters of 12 spores; if dispersed, 20 spores to innumerable	Diagnostic for MF

MF = *Malassezia* folliculitis

The diagnosis of MF could also be supported by Wood's light examination, biopsy with histopathological examination, culture, and molecular analyses.[2,4,5] Wood's light examination of papulopustular lesions fluoresce a bright yellow-green colour, or sometimes bright blue or white fluorescence indicates MF. In contrast, the red reflection indicates acne lesions infected with *Propionibacterium acnes*.[5] Biopsy plus histopathological examination is an invasive examination requiring a long time with lower sensitivity and accuracy than cytologic examination.[6,19] Cultures of *Malassezia* are rarely required for diagnosis and not clinically relevant because those species are part of skin normal flora.[3,20] Cultures and molecular analysis are helpful mainly for species identification, which is necessary for epidemiological investigation.[2,19]

As a non-invasive auxiliary tool, dermoscopy has also been shown to be helpful in identifying and diagnosing the presence of MF as shown by recent studies by Jakhar et al. in India and Durdu et al. in Turkey.[6,8] This device uses a handheld microscope called a dermatoscope (or dermoscope) equipped with a magnification lens and a light source, allowing the observer to examine the primary subsurface morphology of cutaneous lesions. Therefore, it is not a simple magnification of surface features. The basic principle of dermoscopy is transillumination of a lesion and examination with high magnification (usually a magnification of ×10 in most standard dermoscopes) to visualize subtle features.[21]

On a direct examination using magnifying loupe and lighting, most of the light is scattered due to the reflective property of the stratum corneum. An option to overcome this problem is by allowing more light to pass through the stratum corneum, enabling the examiner to look deeper into the skin to increase the diagnostic accuracy. Alternatively, it can be done using a fluid medium as an interface and a transparent glass contact plate (non-polarized dermoscopy) or a cross-polarized light (polarized dermoscopy). Newer dermoscope come with an option of polarized light, allowing both contact and noncontact dermoscopy. Figure 4 shows the schematic representation of optical properties of light with the use of non-polarized and polarized dermoscopy.[21]

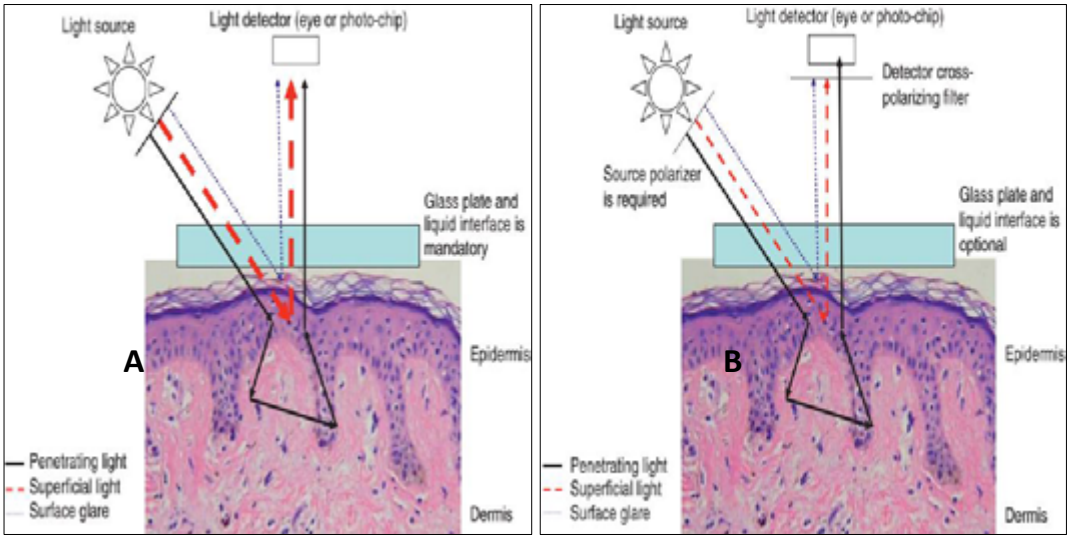
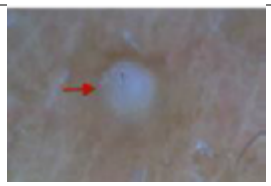
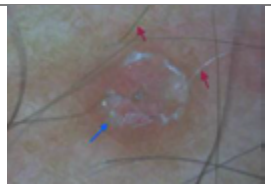
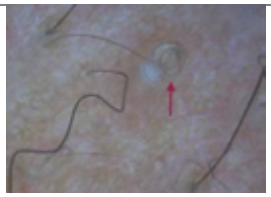
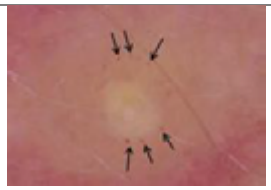


Figure 4. The schematic representation of optical properties of light. A. In contact nonpolarized with a liquid interface: most of the light is absorbed and reflected from the superficial layers of the epidermis after undergoing minimal scattering events; B. In polarized dermoscopy: light emitted from the dermoscopy unit (source) passes through a polarizer resulting in the generation of polarized (unidirectional) light; light reflecting toward our eye (detector) must first pass through a cross-polarized filter whose direction is perpendicular (orthogonal) to that of the source polarizer.[21]

The most important criteria for dermoscopy in general dermatology are: (1) the morphology /arrangement of vascular structures, (2) scaling patterns, (3) colours, (4) follicular abnormalities, and (5) specific features (clues). Dermoscopic findings must be interpreted within the overall clinical context of the patient (personal/family history, number, location, morphology and distribution of the lesions, etc.) because only the combination of such data can improve the diagnostic accuracy in the field of general dermatological disorders.[22] Table 2 presents the compilation of dermoscopic features of MF the percentage from the studies by Jakhar et al. and Durdu et al. Perilesional brownish discoloration in resolving MF lesions proposed by Jakhar et al. was non-specific. Therefore, it is not included in the compilation of the dermoscopic features of MF.[6,8]

Table 2. Dermoscopic features of *Malassezia* folliculitis.[6,8]

No.	Dermoscopic features	Descriptions
1		Folliculocentric papule and pustules with surrounding erythema (100%)
2		Dirty white perilesional scales (73.3%)
3		Coiled/looped hairs with perifollicular erythema and scaling (53.3%)
4		Hypopigmentation of involved hair follicles (60%)
5		Peripheral, regularly distributed dotted vessels in the absence of other diagnostic findings (specificity 93.1%, sensitivity 67.3%)

DISCUSSION

MF is often misdiagnosed as acne vulgaris or bacterial folliculitis.[4] Durdu et al. reported that 30.6% of MF patients had previously been misdiagnosed and received treatment with oral antibiotics.[2] Antibiotic treatment can interfere with normal flora and further aggravate MF. Therefore, it is important to distinguish MF lesions from acne vulgaris as MF lesions do not respond to either oral or topical antibiotics, are not present with comedones, and are often moderately itchy. A patient can have those two diseases at the same time. Therefore, combining antifungal treatments and typical acne medications may be necessary.[4,20]

Previous studies have indicated that dermoscopy provides a new level of clinical morphology of the lesions linking to the underlying histopathology. Several dermoscopic patterns have also been found to have consistency with certain diseases, so the results of dermoscopic examination are very likely to be used as a basis for diagnosis.[6] The dermoscopic features of MF seem to correlate with the current understanding of its etiopathogenesis, i.e., the disease is thought to be an infection followed by inflammation of the hair follicles caused by the fungus genus *Malassezia*.[8,11]

The basis of the pathogenesis that causes MF dermoscopy features has not been fully elucidated. The

two previous studies only evaluated the typical findings of the dermoscopic features in MF patients. Histopathological examination of MF lesions showed dilatation of hair follicles blocked by keratin, cellular debris, sebum, and inflammatory cells, which on dermoscopic examination appear as a feature of folliculocentric papule and pustules with surrounding erythema.[4,8] PAS staining can clearly show the number of *Malassezia* sp. in the follicular infundibulum, and the growth of the fungus can stimulate the scales production and aggravate the occlusion.[23] The scales will appear as dirty white perilesional scales on dermoscopic examination.[8] The scale is a result of hyperkeratosis without exudation, which in this case, is likely caused by impaired epithelial barrier function due to lipase and phospholipase activities, sensitization to cross-reaction of produced allergens, irritant reaction, and non-immunogenic stimulation from the immune system by *Malassezia* sp.[4,13,22] Anane et al. reported that the yeast cells of *Malassezia* sp. could also be found around the hair shaft on the KOH examination of hair follicle samplings with a cellophane stripping (scotch tape). The feature is in accordance with the type of ectothrix fungal infection, which can cause the hair shaft to appear white or coiled/looped in dermoscopic examination.[8,19,24] Attention should be given to the face area to make sure that the findings are black terminal hair that turned into hypopigmentation or indeed a white vellus hair.[25]

The dotted vessels that appear in red spots are not a specific feature for MF because they can be found in other cases, such as psoriasis, dermatophytosis, and other groups of papulosquamous dermatoses. The typical characteristic in MF cases is a regular distribution at the edge of the lesion. It could not be found in other cases of folliculitis, thus it was stated to have a high specificity rate.[6,22,26] Dotted vessels histologically correspond to the tips of vertically arranged, dilated vessels in dermal papillae.[22] Study by Ankad et al. reported that the lesions of dermatophyte infection also showed dotted vessels as the end of dilated blood vessels due to an acute inflammatory process.[26] The possible underlying pathogenesis process to the dermoscopic features of MF proposed by Jakhar et al. and Durdu et al. indicate that those features are sufficient for establishing the initial diagnosis of MF. However, it must be noted that it was not intended to replace the primary role of mycological examination as a gold standard.

CONCLUSION

The dermoscopy examination is expected to act as a complement or alternative means in the event of no access to mycological laboratory facilities. This study was only conducted descriptively, so the sensitivity and specificity of the examination could not be calculated. Another limitation is that it did not specifically record the scraped lesions for the KOH examination so that they could not be related to the dermoscopic features obtained from the same lesions.

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