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Diagnosis of hypopigmented skin diseases

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Abstract
Hypopigmented or depigmented lesions are significant dermatological conditions that frequently occur in regular clinical practice. Accurate diagnosis is of greatest significance. Dermoscopy has been shown to be a valuable technique for the screening, diagnosis, follow-up, and treatment of several common dermatological issues, skin cancers, and pigmentary melanocytic lesions. Dermoscopy enhances the visibility of underlying skin structures by increasing the skin's translucency. Primarily used in the assessment of pigmented lesions, it has shown a higher level of effectiveness compared to clinical inspection. While dermoscopy has not been widely used in those with light complexion, its significance is also growing in populations with dark skin.

Keywords: Hypopigmented lesions, depigmented lesions, dermoscopy

Introduction
Hypopigmented or depigmented skin lesions are among the most common dermatological disorders. These categories of eruptions are quite difficult to be diagnosed and in addition they have great impact on patients' quality of life especially if they have dark skin [1].
Hypopigmentation macules are quite prevalent (in both children and adults), affecting at least one out of every twenty people [2, 3]. The occurrence of different hypomelanotic illnesses varies based on patient characteristics such as age, gender, race, as well as geographical location, family history, and exposure to the environment. Pityriasis alba, for instance, is more prevalent (90%) in children. Dermatoscopy has become more often used in recent years to diagnose general dermatological conditions like such as inflammatory dermatoses, pigmentary dermatoses, infectious dermatoses, and problems with the hair, scalp, and nails.

Hypopigmented or depigmented skin lesions fall into many categories that are either acquired or congenital [1].

Congenital conditions include
- Autosomal recessive inheritance of albinism.
- Autosomal dominating inheritance of piebaldism.
- Hypomelanosis of Ito (chromosomal abnormality).

Acquired hypopigmented conditions include
- **Normal aging or environmental factors:** cumulative sun exposure, microtrauma and idiopathic guttate melanosis (IGH)
- Nutritional deficits include vitamin B12, copper, iron, and kwashiorkor, a severe form of protein malnutrition. Inflammatory causes: pityriasis alba (PA) (association with atopic dermatitis)
- **Vascular reasons (venous obstruction):** Bier's spots.
- Autoimmune causes include hypopigmented sarcoidosis and vitiligo.

Infectious causes
- The fungus Pityriasis versicolor is a species of Malassezia.
- Propionibacterium acnes: Leprosy, Mycobacterium leprae: Leprosy, and Treponema

pallidum: Syphilitic leukoderma Protozoal: post kalaazar dermal leishmaniasis

- Postviral exanthem, specifically eruptive hypomelanosis, is a condition characterized by the appearance of skin lesions after a viral infection.
- Chemical exposure includes the use of lead-based cosmetics and skin bleaching treatments such as hydroquinone.
- Post-inflammatory alterations may occur as a result of several cutaneous inflammatory disorders (such as lichen striatus and atopic dermatitis), infections (such as PVC, herpes zoster, and syphilis), treatments (such as cryotherapy and dermabrasion), and other reasons (such as burns).
- Malignancy: Hypopigmented mycosis fungoides (MF), a tumor originating from the follicular infundibulum.
- Inherited conditions: Ash leaf patches are a characteristic feature of tuberous sclerosis (TS).

Techniques and types of dermatoscopes

Physicians can see the various structures present in the skin layers using polarised and nonpolarized dermoscopy procedures, which help with the thorough examination of dermoscopic patterns. The natural light that strikes the surface of the skin is refracted, diffracted, and mostly reflected, with very little of it being absorbed by the object. As a result, we are unable to see the deeper structures within a given skin lesion with our eyes. For instance, a well-defined bluish plaque is the outward manifestation of a hypertrophic lichen planus lesion. It is necessary to reduce this "specular reflectance" to see deeper structures. This is accomplished either by utilizing an interface material between a glass plate with an ideal refractive index or by using a method known as "polarised dermoscopy" [4].

Dermoscopy can be classified based on the illumination mode used (polarized and non-polarized dermoscopy), whether the dermoscope's face plate is in contact with the lesion's surface or not (contact and non-contact dermoscopy), and the type of dermoscope used (hand-held or videodermoscopy) [5].

Polarised and Non-polarised Dermoscopy

To view the sub-surface structures of the skin, polarised dermoscopy uses two sets of polarisers, a source polariser and a detection polariser. Variable depths of polarised light that have been scattered by the source polariser enter the skin. The other component only experiences simple surface reflection. The detector polariser reduces surface glare by allowing only dispersed light from the deeper section of the scene to enter the light detector rather than surface-reflected light, allowing sight of deeper structures up to 100 mm below the surface. The majority of the light entering the light detector in non-polarized dermoscopy is surface-reflected light. Ultrasound gel is the most popular used medium because of its viscosity, semitransparency, and inertness. Additionally, it is only employed to examine the convex surface of nails and lesions that are close to the eyes [6].

Non-polarized dermoscopy provides a clearer view of surface features and structures, such as rugosity, papillary projections, depressions, scaling, milia-like cysts, and comedonal openings. On the other hand, polarized dermoscopy offers a clearer view of sub-surface structures like collagen, blood vessels, and granulomas. Both lighting modes should be used during dermoscopy to comprehensively examine the surface and sub-surface attributes of a skin lesion [7].

Contact and non-contact dermoscopy

In contact dermoscopy, the dermoscope's face plate is close to the lesional surface. Although it is not always necessary, contact dermoscopy with an interface fluid surface can be utilized in polarised dermoscopy as well to improve the lighting and resolution of the structures. Contact dermoscopy can provide improved lighting and resolution, but there are drawbacks as well. For example, the pressure of the contact might compress structures like blood vessels, increasing the risk of infection transfer and necessitating the sterilization of the contact plate. Non- contact dermoscopy eliminates all of these drawbacks, albeit at the expense of poor lighting and resolution [8, 9].

Dermoscopic patterns in vitiligo

- **Diffuse white glow:** It is regarded as the vitiligo diagnostic clue that resembles a glow from a full moon. It corresponds to the light that is reflected from the top dermal layers but would normally be absorbed by the basal cell layer's melanin [10].
- **Abnormal pigment network:** Vitiligo lacks the typical reticular pigment network. In developing cases, it could seem broken with hazy borders. It can occasionally appear inverted with white lines and darker-colored spots [10].
- **Lesional, perilesional and perifollicular alteration:** They come in a variety of shapes, and one sign of activity is perifollicular depigmentation with an intact interfollicular pigment network.
- **Dermoscopic findings in early vitiligo:** Early illness is characterized by the absence or reduction of the reversed pigment network, perifollicular and perilesional hyperpigmentation, and diffuse white glow [11]. Leukotrichia in the skin that is not yet vitiliginous is an early symptom of vitiligo [12]. (Figure 1).

Idiopathic Guttate Hypomelanosis

Four distinct dermoscopic patterns have been identified in IGH, including amoeboid, feathery, petaloid, and nebuloid patterns. These patterns are determined by the various angles of white regions at the outside edges.

1. The amoeboid pattern is characterized by the presence of diffuse, structureless white regions that stretch outward, resembling pseudopods like those seen in amoebas. Feather-like spreading of margins, is referred to as feathery pattern.
2. The petaloid pattern is distinguished by well-defined boundaries that resemble the petals of a flower.
3. The nebuloid pattern is characterized by its indistinct boundaries, which are unique to this kind. It is important to observe that the final pattern has a strong resemblance to guttate vitiligo. It is important to mention that in all categories, the boundaries are clearly delineated [13].

The condition known as IGH in individuals with Fitzpatrick skin Types I, II, and III is characterized by two clearly different dermoscopic patterns: cloudy sky-like and cloudy patterns. The variation is likely due to differences in skin color and the length of time the lesions persist [14].

White structureless regions that extend peripherally in various forms are seen in all the mentioned patterns. The presence of white structureless patches is a result of a decrease in melanin content inside the epidermis [15].
Perifollicular, perilesional pigmentation, and diffuse pigmentation with linear and branching vessels are seldom seen [15]. The pigmentation is more prominent in those with darker skin tones.
The background color is characterized by a dazzling white appearance, with a perifollicular and perilesional pigmentation pattern. Linear vessels, while rare, contribute to the overall vascular pattern. There are no observed alterations in terms of the size or arrangement of hair follicles. The presence of angulated and well-defined boundaries is a distinctive characteristic of IGH. (Figure 1).

Lichen Sclerosus Et Atrophicus (LSEA)
The dermoscopy of LSEA reveals distinct characteristics in the first inflammatory and advanced sclerotic lesions. Inflammatory lesions exhibit white areas without a defined structure, openings resembling comedones, linear dilation of blood vessels with varying sizes, and a scattered pattern of gray-blue and brown dots. These characteristics correspond to fibrosis in the skin, blockages in the hair follicles, enlargement of capillaries, and the presence of melanophages in both the epidermis and dermis [16]. (Figure 1).

Pityriasis Alba
There is little research on the use of dermoscopy in the field of PA. There are not many publications that provide detailed descriptions of white regions that lack organization and have unclear boundaries. Small scales are seen in the middle of the lesion. Whitish regions have subtle brownish pigment network. It is important to observe that scales are pale in color and are dispersed in a concentrated manner, although they are not easily noticeable in the lines of skin cleavage. This specific dermoscopic characteristic distinguishes PA from pityriasis versicolor (PVC). (Figure 1).

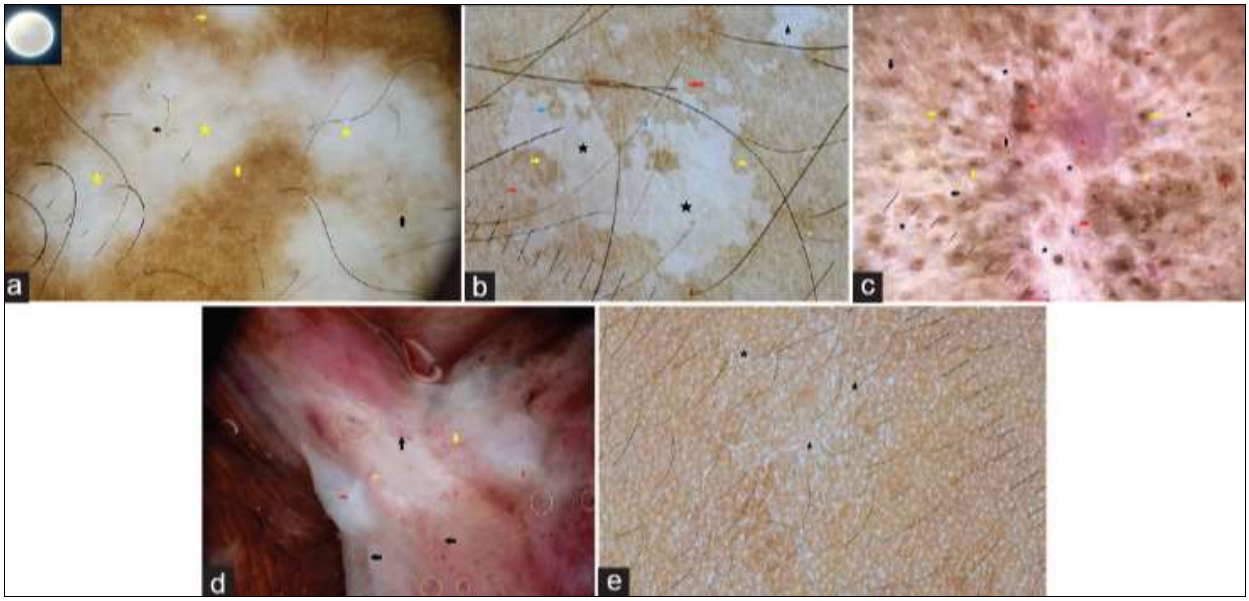

Fig 1: (a) Dermoscopy of vitiligo reveals white structureless regions known as "white glow" (shown by yellow stars), perilesional pigmentation (indicated by yellow arrows), and residual pigmentation (indicated by black arrow) inside the white area. Observe the pale hue in the backdrop. (b) Dermoscopy of idiopathic guttate hypomelanosis reveals a white, featureless region (shown by black stars) with elongated projections resembling pseudopods (highlighted by red arrows) at the outside edges. The presence of pigmentation around the lesion (shown by yellow arrows) and around the hair follicles (indicated by blue arrows) is clearly seen. Observe the tinge of brown in the backdrop. (c) Dermoscopy of lichen sclerosus et atrophicus reveals the presence of follicular plugs (comedo-like holes) shown by yellow arrows, telangiectasia indicated by black arrows, white regions indicated by black stars, and brown pigmentation indicated by red arrows. Observe the pinkish region located in the center (indicated by a red star) and the pinkish-white hue in the backdrop. (d) Dermoscopy of genital lichen sclerosus et atrophicus reveals the presence of many brown spots (shown by black arrows) and blue-gray dots (indicated by yellow circles), together with linear and branched telangiectasia (indicated by yellow arrows). The reflective white strands, sometimes known as chrysalis threads, are clearly visible and highly valued, as shown by the red arrows. Observe the pale pink hue in the backdrop. (e) Dermoscopy of pityriasis alba reveals a poorly defined region with widespread white scales (shown by black stars) that cover the whole affected area. The subtle pigment network is well recognized. Observe the brownish-white hue in the backdrop [15]

Leprosy (Hypopigmented Patch)
Dermoscopy reveals distinct patterns in areas of reduced pigmentation in leprosy. The dermoscopic patterns include white regions, faint brownish pigment network with deformation, diminished white dots (eccrine and follicular openings), and alterations in hair such as pigtail hairs, short or fragmented hairs, and V-shaped hairs. No scales are discernible. Vascular alterations are absent in flat hypopigmented areas of leprosy due to the destruction of vascular structures by granuloma. However, elevated (plaque, nodules, reactional lesions) and facial lesions have vascular components because of inflammation and abundant blood supply, respectively. Therefore, the presence of yellow globules with telangiectasia, which are indicative of a granuloma, is not often seen in leprosy patches, particularly in facial and elevated lesions in areas outside the face [17, 18]. (Figure 2).

Pityriasis Versicolor
Vitiligo, PA, indeterminate leprosy, and PMH have

similarities with hypopigmented lesions of PVC. Dermoscopy offers valuable morphological data for clinical diagnosis and distinguishing PVC from other hypopigmented conditions. The image displays dispersed white regions without any distinct structure, accompanied by a faint pattern of pigmented lines in the backdrop. The boundaries of the lesion remain unclear. The whole lesions are covered with fine white scales. Scaling may manifest either as focal or in perifollicular or perilesional regions, as well as in the skin's cleavage lines [19, 20]. The scales inside the skin furrows separate from the skin and fracture into two pieces when the lesions are stretched. Authors often refer to it as "bipolar" or "dual-sided" scales. (Figure 2)

Nevus Depigmentosus (ND)

Dermoscopy aids in distinguishing ND from vitiligo, ash leaf macules, and other hypopigmented diseases [21]. The dermoscopy of the ND reveals white patches without distinct structures, a faint and consistent reticular pigment network throughout the lesion, and pigmentation around the hair follicles [22]. The white structureless region expands outward like pseudopods. These refer to the jagged edges of ND. (Figure 2).

Progressive Macular Hypomelanosis

From a clinical perspective, the patient's past medical history is characterized by the presence of non-scaly, hypopigmented macules that merge together to create patches. The distribution of lesions involving the trunk and back exhibits symmetry [23]. It is essential to differentiate between PMH, vitiligo, and hypopigmented patches of leprosy because to the significant differences in the treatment approaches for these disorders. Furthermore, the patient's psychology is significantly influenced by the dread of social stigma associated with white-colored lesions. Therefore, a precise diagnosis is crucial. Within the patient's medical history (PMH), there are seen regions that are either concentrated or spread out, appearing white in color, with a faint network-like pattern of pigment in the backdrop. The presence of white scales is minor and limited exclusively to the lines where the skin naturally folds.

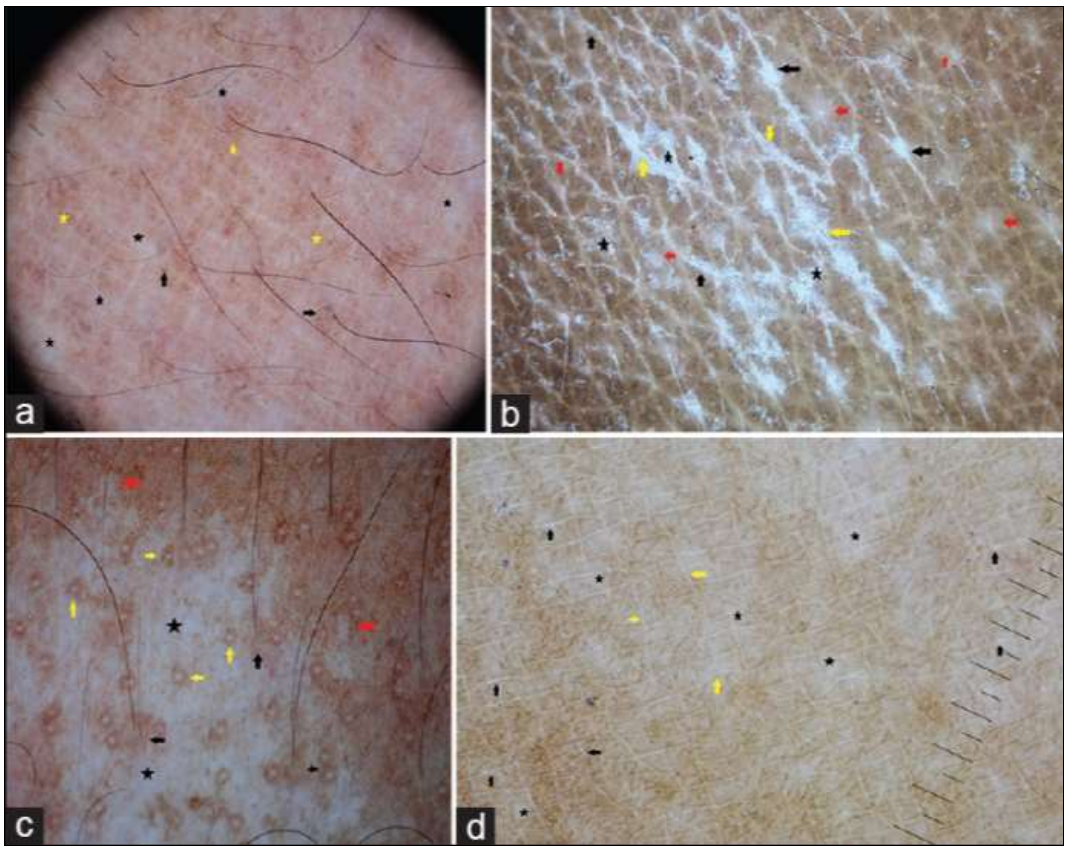

Fig 2: The dermoscopy of the flat hypopigmented lesion of leprosy reveals specific features such as isolated white regions, broken hairs, pigtail hairs, and a faint pigment network inside the lesion. Observe the decrease in the number of white spots (eccrine and follicular apertures) and the expansion of skin cleavage lines. The hue that is a mixture of brown and white is highly valued. (b) Pityriasis versicolor dermoscopy reveals widespread white scales (black stars) that are particularly noticeable in skin creases (black arrows) and localized white patches (red arrows). The presence of double-edged scales (shown by yellow arrows) is seen as a result of the stretching of the lesion. Observe the delicate pigment network. The background's brownish-white tint is well admired. The dermoscopy of nevus depigmentosus reveals white patches without any discernible structure, shown by black stars. These white areas also exhibit pigmentation around hair follicles (indicated by black arrows) and sweat glands (indicated by yellow arrows). The white areas spread outward in a manner resembling pseudopods, as indicated by red arrows. Observe the consistent brownish pigment network and the brownish-white tint in the backdrop. (d) Dermoscopy of progressive macular hypomelanosis reveals localized depigmented regions (shown by black stars), white scales (indicated by black arrows) limited to the lines where the skin naturally folds, and patches of brownish pigmentation. Observe the expanded skin creases (shown by yellow arrows) and the brownish-white hue in the backdrop.

Conclusion

Dermoscopy proves to be a valuable diagnostic tool for hypopigmented or depigmented skin lesions, offering enhanced visibility of skin structures which significantly aids in the accurate diagnosis of various dermatological conditions. The utility of dermoscopy extends beyond the evaluation of pigmented lesions and is becoming increasingly recognized in populations with darker skin tones. Its effectiveness in diagnosing a wide array of dermatological issues-ranging from inflammatory and infectious dermatoses to pigmentary conditions and even certain malignancies-underscores its importance in clinical practice.

The prevalence and impact of hypopigmented lesions, such as pityriasis Alba in children and various acquired conditions in adults, highlight the necessity for precise diagnostic techniques. Dermoscopy not only facilitates the differentiation between similar presenting conditions, such as vitiligo and progressive macular hypomelanosis but also assists in the management and follow-up of these conditions. The ability to identify specific dermoscopic features, like the reticular pigment network and pigmentation patterns around hair follicles, is crucial for distinguishing between conditions like nevus depigmentosus and other hypopigmented diseases.

The incorporation of dermoscopy into routine dermatological assessments significantly enhances diagnostic accuracy and patient management, particularly for hypopigmented and depigmented lesions. The growing application of this technique across diverse skin types and conditions further validates its role as an indispensable tool in dermatology.

Conflict of Interest

Not available.

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