

Dermoscopic rainbow pattern: A strong clue to malignancy or just a light show?

 Omer Faruk Elmas,¹  Herman Mayisoglu,²  Murat Celik,³  Asuman Kilitci,⁴  Necmettin Akdeniz⁵

¹Department of Dermatology and Venerology, Ahi Evran University Faculty of Medicine, Kirsehir, Turkey

²Department of Dermatology and Venerology, Medicana Hospital, Istanbul, Turkey

³Department of Pathology, Kars State Hospital, Kars, Turkey

⁴Department of Pathology, Ahi Evran University Faculty of Medicine, Kirsehir, Turkey

⁵Department of Dermatology and Venerology, Istanbul Medeniyet University Faculty of Medicine, Istanbul, Turkey

ABSTRACT

OBJECTIVE: Rainbow pattern is a dermoscopic finding composed of multiple colors simulating a rainbow. It is known as a characteristic feature of Kaposi's sarcoma. Here, we reported different non-Kaposi's sarcoma conditions with a rainbow pattern aiming to discuss the diagnostic significance of the finding.

METHODS: In this multicenter study, dermoscopic images of the non-Kaposi's sarcoma lesions having a histopathological diagnosis were reviewed for the presence of a rainbow pattern. Dermoscopic examination was performed by a polarized handheld dermoscope with x10 magnification.

RESULTS: A total of 840 lesions were reviewed and 21 (2%) non-Kaposi sarcoma lesions having dermoscopic rainbow pattern were detected. These lesions were as follows; pyogenic granuloma (n=4, 19%), hypertrophic scar (n=4, 19%), basal cell carcinoma (n=2, 10%), dermatofibroma (n=2, 10%), angiokeratoma (n=2, 10%), blue nevus (n=1, 5%), granuloma annulare (n=1, 5%), strawberry angioma (n=1, 5%), epidermal cyst (n=1, 5%), malignant melanoma (n=1, 5%), dissecting cellulitis (n=1, 5%) and subungual hematoma (n=1, 5%). The most common localization was limb (n=14, 67%) followed by face (n=3, 14%).

CONCLUSION: We suggest that the rainbow pattern is a complex and quite unspecific optic phenomenon which can be seen both in vascular and non-vascular lesions. Its diagnostic significance should be considered in the context of the other structural dermoscopic finding. To the best of our knowledge, to our knowledge, this is the most comprehensive study focusing on rainbow pattern in non-Kaposi's sarcoma lesions. Here, we also reported rainbow pattern in dissecting cellulitis, granuloma annulare and subungual hematoma which has not been shown to have rainbow pattern previously.

Keywords: Dermoscopy; Kaposi's sarcoma; optic phenomenon; rainbow pattern.

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Rainbow pattern (RP) is first described by Hu et al. as a multicolored dermoscopic finding composed of multiple colors simulating a rainbow which does not have a peculiar histopathological correlation [1, 2]. Initially, the pattern was considered as a highly specific dermoscopic

clue to Kaposi's sarcoma [3]. Recently, however, diagnostic significance of RP has been a subject of debate [4, 5]. Current literature reported RP in many different conditions, including lichen planus, melanoma, dermatofibroma, angiokeratoma, blue nevus, scars, acroangiodermatitis and



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Correspondence: Omer Faruk ELMAS, MD. Ahi Evran Universitesi Tip Fakultesi, Dermatoloji ve Veneroloji Klinigi, Kirsehir, Turkey.
Tel: +90 386 213 45 15 e-mail: omerfarukmd@gmail.com

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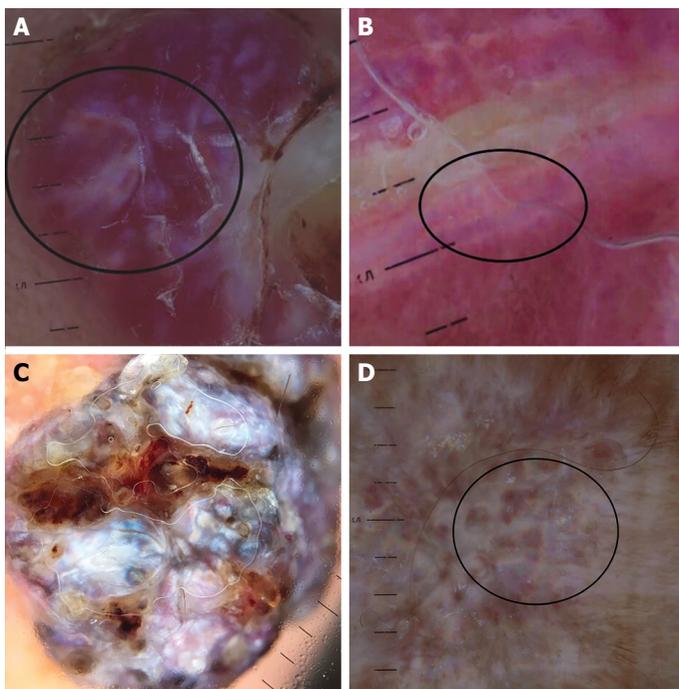


FIGURE 1. Dermoscopic rainbow pattern in pyogenic granuloma (A), hypertrophic scar (B), basal cell carcinoma (C) and dermatofibroma (D).

stasis dermatitis [1, 4, 5]. In this study, we also reported different non-Kaposi's sarcoma conditions with RP aiming to discuss diagnostic significance of the finding.

MATERIALS AND METHODS

In this multicenter study, dermoscopic images of the lesions having a histopathological diagnosis were reviewed retrospectively for presence of RP. The lesions were collected from outpatient clinics of three centers between June 2016 and January 2019. Dermoscopic examination was performed by a polarized handheld dermoscope with x10 magnification (Dermlite 4, 3GEN Inc, San Juan Capistrano, CA, USA). Capture of dermoscopic images was done using a high-resolution mobile camera phone attached to the dermoscope (iPhone 7 plus, Apple Inc, CA, USA). An additional x2 digital zoom was used to achieve a total of x20 magnification. All the procedures followed were in accordance with the Helsinki Declaration and this study was approved by the local clinical research ethics committee (Ethical clearance number and date: 2019-01/09, 08.01.2019).

Statistical Analysis

SPSS Windows version 24.0 package software (SPSS Inc., Chicago, IL, USA) was used for descriptive statistical analysis.

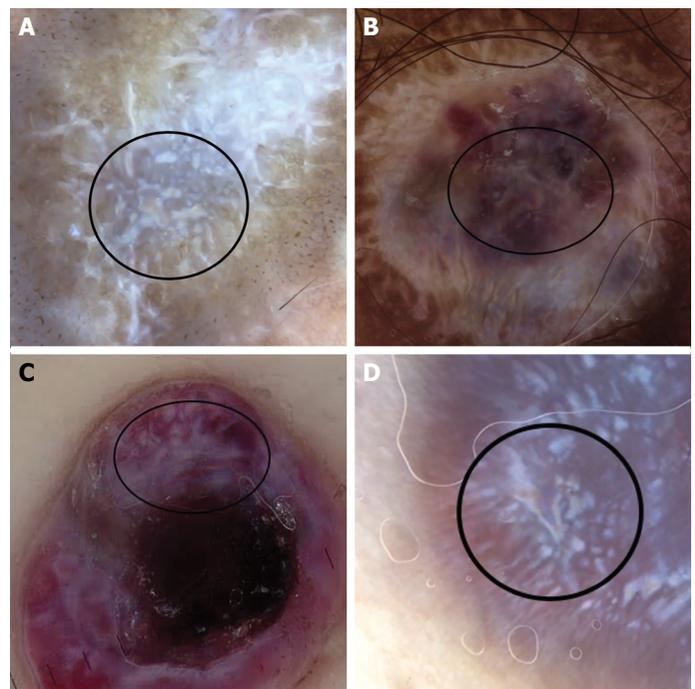


FIGURE 2. Dermoscopic rainbow pattern in dermatofibroma (A), angiokeratoma (B), angiokeratoma (C) and blue nevus (D).

RESULTS

In this study, 840 lesions, including nevi, benign and malignant adnexal tumors, vascular lesions, basal cell carcinomas, squamous cell carcinomas, melanomas, epidermal cysts, subungual and subcorneal hematomas, and scars, were retrospectively reviewed. We detected a total of 21 non-Kaposi sarcoma lesions having dermoscopic RP. These lesions were as follows: pyogenic granuloma (n=4, 19%) (Fig. 1A), hypertrophic scar (n=4, 19%) (Fig. 1B), basal cell carcinoma (n=2, 10%) (Fig. 1C), dermatofibroma (n=2, 10%) (Fig. 1D, Fig. 2A), angiokeratoma (n=2, 10%) (Fig. 2B, C), blue nevus (n=1, 5%) (Fig. 2D), granuloma annulare (n=1, 5%) (Fig. 3a), strawberry angioma (n=1, 5%) (Fig. 3Bb), epidermal cyst (n=1, 5%), malignant melanoma (n=1, 5%) (Fig. 3C), dissecting cellulitis and subungual hematoma (n=1, 5%) (Fig. 3D). The mean age of the patient was 48 years. The majority of the participants in this study was male (62%). The most common localization was limb (n=14, 67%) followed by face (n=3, 14%).

The demographic parameters and dermoscopic features of the lesions have been shown in Table 1.

DISCUSSION

RP was previously thought to be related with distinctive

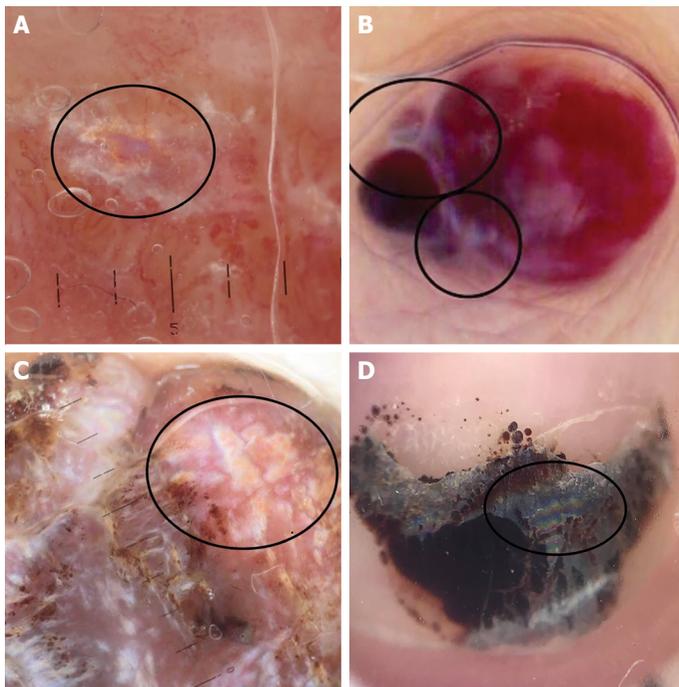


FIGURE 3. Dermoscopic rainbow pattern in granuloma annulare (A), strawberry angioma (B), malignant melanoma (C) and subungual hematoma (D).

microscopic vascular structures. This hypothesis may explain RP observed in vascular lesions like Kaposi's sarcoma and pyogenic granuloma; however, it fails to explain presence of RP in non-vascular lesions. Recently, RP has been considered as a more complex optic phenomenon. It has been suggested that polarized light interacts with not only vascular structures but also different parts of skin structures as it passes through skin [5].

When reviewing the literature, there are few studies focusing on the RP in non-Kaposi's sarcoma lesions and all of them are case reports or case series, including few numbers of patient. Cheng et al. [3] claimed that RP is highly specific to Kaposi's sarcoma. They suggested that the light beam is diffracted in the dermis and this may be the possible mechanism of RP. Then, Vázquez-López et al. [5] pointed out the term "dichroism" which suggested a more complex interaction with polarized lights. According to this hypothesis, light in different status of polarization is absorbed in different amounts as it penetrates into an object. Heterogenous and layered nature of dermis determine the absorbance and retardance of polarized light resulting a spectrum of colors. A fluid application (e.g., immersion oil and isopropyl alcohol) may also enhance the effects of the polarized light. We observed the application of isopropyl alcohol enhances the appearance

of RP. However, RP has not been detected in any case on non-polarized dermoscopy with or without fluid.

Satta et al. [6] claimed that RP is only seen in raised lesions of Kaposi's sarcoma and is totally absent in macular stage of the disease. They suggested that spindle cell proliferation arranged as bundles around vascular structures in varying size and shape cause RP in nodular Kaposi's sarcoma.

In the present study, 24% (n=5) percent of the lesions showing RP were vascular proliferations, including pyogenic granuloma, strawberry angioma, angiokeratoma and, most of the lesions (n=17, 81%) showed dermoscopic and histopathological evidence of increased superficial dermal vascularity. Pyogenic granuloma and nodular Kaposi's sarcoma may demonstrate similar clinical and dermoscopic findings [7, 8]. Given the non-specific nature of RP, other dermoscopic clues should be considered in the differential diagnosis between the two entity. In a recent study, we concluded that the presence of reddish structureless areas along with intersecting thick white lines is a strong dermoscopic clue to PG [8].

The site of the lesion may also contribute to RP. In the study of Kelati et al. [4], almost all the lesions were located to the limbs. In the present study, 67 percent of the lesions were also located to the limbs. Peculiar vasculature of the limbs may be an additional factor for RP formation.

Pyogenic granuloma, angiokeratoma, scars, melanoma, basal cell carcinoma, dermatofibroma, blue nevus and Merkel cell carcinoma were previously reported to show RP [1, 4, 5, 9–11]. To our knowledge, RP has not been described for granuloma annulare, dissecting cellulitis and subungual hematoma previously. It was remarkable that, both dermoscopy and histopathology of the granuloma annulare case showed prominent superficial vascular structures. Dermoscopy of the subungual hematoma showed different color and shades of blood which may correspond RP.

In this study, overwhelming majority of the lesions was benign and just three lesions (two basal cell carcinomas and one melanoma) were malignant. In this context, RP cannot be considered as a clue to malignancy alone. Exceptionally, high incidence of RP in Kaposi's sarcoma should be noted.

It can be concluded that vascular structures are more tend to interact with polarized light and this explains the frequency of RP in vascular lesions; however, non-vascular elements of the skin may also have an interaction with polarized light resulting RP. In the present study, 19

TABLE 1. The demographic parameters and dermoscopic features of the lesions

| Case number | Diagnosis | Age | Gender | Site | Diagnosis |
|-------------|-----------------------|-----|--------|-------------|--|
| 1 | Pyogenic granuloma | 57 | Female | Limb | Rainbow pattern, red and white structureless areas, white clods, ulceration, linear and dotted vessels, collarette scale |
| 2 | Pyogenic granuloma | 11 | Male | Neck | Rainbow pattern, red structureless areas, white intersecting lines, white clods, ulceration, linear and dotted vessels |
| 3 | Pyogenic granuloma | 36 | Female | Limb | Rainbow pattern, red structureless areas, white intersecting lines, linear vessels |
| 4 | Pyogenic granuloma | 24 | Male | Limb | Rainbow pattern, red structureless areas, white intersecting lines, ulceration |
| 5 | Strawberry angioma | 32 | Male | Trunk | Rainbow pattern, red structureless, white clods, ulceration, crust |
| 6 | Angiokeratoma | 69 | Female | Limb | Rainbow pattern, purple, red, brown and white structureless areas, white thick lines |
| 7 | Angiokeratoma | 43 | Female | Limb | Rainbow pattern, ulceration, purple and red structureless areas, ulceration, crust |
| 8 | Melanoma | 57 | Male | Limb | Rainbow pattern, white, grey and red structureless areas, white clods, perpendicular white lines, scale |
| 9 | Basal cell carcinoma | 49 | Male | Face | Rainbow pattern, white structureless areas, white clods, thick linear disfocused vessels, ulceration, scale |
| 10 | Basal cell carcinoma | 75 | Female | Face | Rainbow pattern, brown structureless areas, scale, blood spots |
| 11 | Dermatofibroma | 88 | Female | Limb | Rainbow pattern, white structureless areas, white clods, short white lines, peripheral brown lines reticular |
| 12 | Dermatofibroma | 34 | Female | Limb | Rainbow pattern, central white lines reticular, peripheral grey structureless areas, peripheral brown lines reticular |
| 13 | Blue nevus | 29 | Male | Limb | Rainbow pattern, blue to grey structureless areas, white lines, white clods |
| 14 | Granuloma annulare | 50 | Female | Limb | Rainbow pattern, yellow structureless areas, linear irregular and coiled vessels, white clods |
| 15 | Subungual hematoma | 41 | Male | Big toenail | Rainbow pattern, black structureless areas, peripheral brown to black clods |
| 16 | Hypertrophic scar | 34 | Male | Limb | Rainbow pattern, white and red structureless areas, brown lines reticular, white clods, linear irregular and dotted vessels |
| 17 | Hypertrophic scar | 72 | Male | Limb | Rainbow pattern, red structureless, white polarized dots, clods and perpendicular lines, dotted vessels in peripheral patchy arrangement |
| 18 | Hypertrophic scar | 58 | Male | Limb | Rainbow pattern, red structureless, the peripheral arrangement of dotted and short linear vessels |
| 19 | Hypertrophic scar | 69 | Male | Limb | Rainbow pattern, red structureless |
| 20 | Dissecting cellulitis | 26 | Male | Head | Rainbow pattern, absence of follicular opening, reddish-yellowish structureless areas, scale |
| 21 | Epidermal cyst | 44 | Male | Face | Rainbow pattern, white, red, purple and yellow structureless areas, peripheral irregular linear vessels |

percent of the lesion did not show any dermoscopic or histopathological evidence of increased vascularity.

We agree that RP is a complex and quite nonspecific optic phenomenon which can be seen both in vascular and non-vascular lesions and it cannot be considered as

a specific clue to Kaposi sarcoma. Its diagnostic significance should be considered in the context of the other structural dermoscopic finding. To our knowledge, this is the most comprehensive study focusing on RP in non-Kaposi's sarcoma lesions.

Ethics Committee Approval: All the procedures followed were in accordance with the Helsinki Declaration and this study was approved by the local clinical research ethics committee (date: 08.01.2019, number: 2019-01/09).

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