

CASE REPORT

In vivo imaging techniques for psoriatic lesions

CONSTANTIN CĂRUNTU¹⁾, DANIEL BODA²⁾, ANA CĂRUNTU³⁾, MARIA ROTARU⁴⁾,
FLAVIA BADERCA⁵⁾, SABINA ZURAC⁶⁾

¹⁾Department of Physiology, "Carol Davila" University of Medicine and Pharmacy, Bucharest, Romania

²⁾Dermatology Research Laboratory, "Carol Davila" University of Medicine and Pharmacy, Bucharest, Romania

³⁾"Prof. Dr. Dan Theodorescu" Oral and Maxillofacial Surgery Hospital, Bucharest, Romania

⁴⁾Department of Dermatology, "Victor Papilian" Faculty of Medicine, "Lucian Blaga" University of Sibiu, Romania

⁵⁾Department of Histology, "Victor Babes" University of Medicine and Pharmacy, Timisoara, Romania

⁶⁾Department of Pathology, "Carol Davila" University of Medicine and Pharmacy, Bucharest, Romania;
Colentina University Hospital, Bucharest, Romania

Abstract

Psoriasis is an inflammatory skin disease, with a polymorphic clinical appearance. Modern techniques for *in vivo* imaging of skin structure, such as reflectance confocal microscopy (RCM) and dermoscopy, could be very useful tools for diagnosis and monitoring of psoriatic lesions. We report a case of psoriasis vulgaris in which we identified certain dermoscopic features suggestive for psoriasis and RCM enabled us to identify *in vivo* most of the histological features of psoriatic lesions.

Keywords: psoriasis, skin, reflectance confocal microscopy, dermoscopy.

□ Introduction

Psoriasis is a common chronic inflammatory skin disorder with a prevalence of 2% worldwide characterized by an increased turnover rate of epidermal cells and hyperproliferation of epidermal keratinocytes [1–7]. Psoriasis may occur at any age but the age of onset has two peaks, one between the age of 16–22 years and another between 57–60 years [8]. The precise cause of psoriasis is still unknown but the interaction between genetic predisposition, immunologic factors and environmental triggers, such as local trauma, infections, alcohol, drugs, psychological stress plays a major role in this complex skin disorder [3, 4, 9–15].

The clinical presentation of psoriasis is polymorphic but the most common form is psoriasis vulgaris [16, 17]. Typical psoriatic lesions are well-demarcated erythematous plaques covered by white scales, which can have different shapes and sizes and are most commonly located on elbows, knees, scalp, arms and lumbar area but may be located all over the body [4, 16, 18, 19].

Even though psoriatic lesions usually have a characteristic clinical appearance and they are easily identified and diagnosed, unusual presentations may be mistaken for other erythematous squamous diseases, such as seborrheic dermatitis, nummular eczema, pityriasis rosea, tinea, pityriasis rubra pilaris, and in those cases skin biopsy with histological evaluation is required to confirm diagnosis [4–6, 16, 17, 20].

Histopathological representation of psoriatic lesions include increased thickness of the stratum corneum (hyperkeratosis), incomplete keratinocyte maturation with presence of nuclei in cornified layer (parakeratosis), focal absence or reduction of granular layer, epidermal thickening (acanthosis) associated with supra-papillary epidermal

thinning and elongation of dermal papillae (papillomatosis) with tortuous, dilated capillaries. In both dermis and epidermis, there is a variable degree of mixed inflammatory response with lymphocytic and neutrophilic infiltration. Trafficking of inflammatory cells through epidermis leads to formation of spongiform pustules (micropustules of Kogoj) with collections of neutrophils in spinous layer or aggregates of neutrophils within parakeratotic areas of the stratum corneum (microabscesses of Munro), which are highly specific for psoriasis [4, 5, 7, 21].

Even though histopathological examination can confirm clinical diagnosis of psoriasis, it is often not performed due to its invasiveness. Moreover, skin biopsy has its limitations in the early phases of disease because the changes may be minor. Also, when psoriatic lesions must be monitored it does not allow assessment of the same skin area over time [5, 7, 16].

Thus, the use of modern techniques for *in vivo* imaging of skin structure may be of real interest for the evaluation of psoriatic lesions.

A non-invasive diagnostic technique that enables *in vivo* observation of skin lesions is dermoscopy and recently have been described certain dermoscopic features that could be of real help for the diagnosis and therapeutic follow up of psoriatic lesions [5, 6, 22–26].

Another novel technique is reflectance confocal microscopy (RCM), which allows a harmless, morphological and functional evaluation of skin lesions with a resolution comparable to conventional light microscopy [27, 28] and recent studies showed that RCM facilitates *in vivo* identification of most of the histological features in psoriasis [5, 7, 17, 29, 30].

We present the case of a patient with multiple erythematous squamous lesions for which an accurate diagnosis was facilitated by dermoscopic and RCM examination.

Materials and Methods

The study was performed in Dermato-oncology Research Laboratory of “Carol Davila” University of Medicine and Pharmacy, Bucharest, Romania in accordance with the guidelines of local ethics committee and after obtaining informed consent from the patient.

A clinically significant skin lesion and one distant non-lesional skin site, both located on the right forearm, were examined and minimal pressure was applied during dermoscopic and RCM investigation.

We used a digital videodermoscopy system (FotoFinder, Teachscreen, Germany) to acquire dermoscopic images.

In vivo RCM was performed with a reflectance-mode confocal laser scanning microscope (Vivascope 1500, Lucid Inc., Rochester, NY, USA) with wavelength of 785 nm, power of the laser source lower than 30 mW, lateral resolution of 1 µm and axial resolution less than 5 µm that allows the assessment of skin structures up to a depth of 200–350 µm with a resolution similar to classical histological examination. The area of each confocal image is 500×500 µm but the system allows joining of multiple images acquired at a similar depth, resulting a mosaic of maximum 8×8 mm. RCM images are recorded with a frame rate of nine frames per second, which enables a real-time micromorphological and functional investigation of skin structures [27, 28, 31–34].

For *in vivo* RCM analysis, full-resolution individual images and a minimum of four mosaics of 6×6 mm to 8×8 mm were acquired at four different skin levels (cornified layer, spinous layer, dermo-epidermal junction, and papillary dermis) were obtained for every skin site.

After RCM imaging, tissue samples were obtained by skin biopsy of the lesion previously investigated.

For histopathological examination, tissue fragments were fixed in 10% buffered formalin and routinely automatically processed using a Tissue Processor STP 420D (ThermoScientific/Microm, Germany) and then embedded in paraffin blocks; paraffin blocks were cut into 3 µm thick sections with a semi-automated Rotary Microtome RM2245 (Leica, Germany). Slides were stained with Hematoxylin–Eosin (HE), Giemsa and Periodic Acid–Schiff (PAS). Sections were analyzed using a Nikon Eclipse 80i microscope with a digital camera attached to a computer.

Results

A 16-year-old woman presented to our clinic with red scaly skin lesions located on the trunk and limbs. Lesions first appeared about one year ago and in the last few months have increased in number and size despite occasional treatment with topical emollients and moisturizers.

Clinical examination revealed multiple sharply demarcated erythematous squamous plaques and papules, located mainly on the forearms, arms, calves, thighs and chest (Figure 1A).

We used dermoscopy and RCM for *in vivo* imaging of a clinically significant lesion and one non-lesional site, located on the same skin area.

Dermoscopy showed dotted vessels arranged in both central part and periphery of the lesion and superficial

white scales distributed over a light red background (Figure 1B).

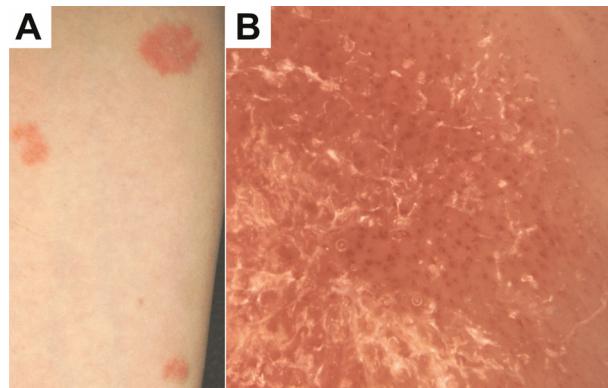


Figure 1 – Correlation between clinical and dermoscopic images: (A) Clinical image showing sharply demarcated erythematous plaques, covered by white scales located on the right forearm; (B) Dermoscopy image with dotted vessels and superficial white scales regularly distributed over a light red background.

RCM examination of epidermis (Figure 2, A–C) exhibited a thick cornified layer with round or polygonal nucleated bright cells corresponding to parakeratotic keratinocytes, sometimes adjacent to highly refractile, elongated structures clustered together, corresponding to accumulation of infiltrating neutrophils in the cornified layer (Munro microabscesses). Epidermal thickness was increased but the granular layer was reduced or even absent in some areas. In the upper portion of the spinous layer with a relatively bright honeycombed pattern we detected dark areas associated with clusters of refractile round cells, which had no corresponding structure in conventional histopathology examination. Also, in certain lesional regions the dermal papillae were visible in the upper part of epidermis.

In comparison to healthy skin, lesional dermal papillae were significantly enlarged without the bright papillary ring and separated by thinner epidermal tissue (Figure 3). Lesional dermal papillae are filled with dilated and tortuous capillaries with increased blood flow in real time imaging. Around the enlarged vessels are visible bright round cells corresponding to perivascular inflammatory cell infiltration (Figures 3 and 2D).

Blood count and serum chemistry were within normal limits.

Clinical appearance, dermoscopy features and RCM findings were suggestive of psoriasis. A biopsy of the skin lesion previously investigated was performed.

Histopathology analysis confirmed the diagnosis of psoriasis vulgaris and revealed the presence of hyperkeratosis and parakeratosis with sparse collections of neutrophils among keratin layers, acanthosis with elongated rete ridges uniformly thickened and fused in the basal part, suprapapillary epidermal thinning, enlarged tortuous capillaries in the papillary dermis and moderate inflammatory infiltrate in the papillary and upper reticular dermis (Figure 2, E and F). Special stains have not shown microbial (Giemsa stain) or fungal (PAS stain) colonies.

Topical treatment with corticosteroids, emollients and moisturizers was recommended, and psoriatic lesions cleared almost completely within the next four weeks.

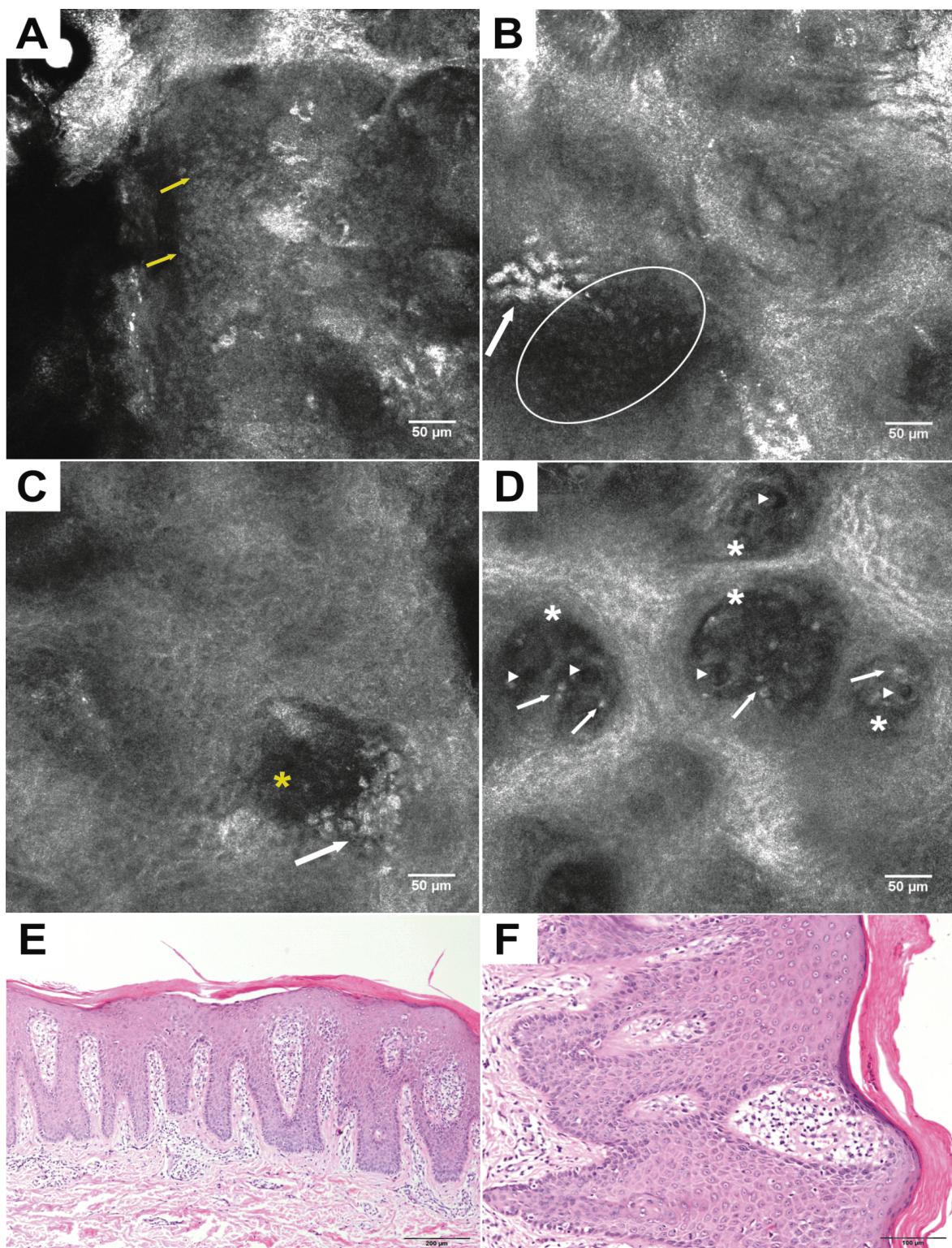


Figure 2 – Correlation between RCM and histopathological images suggestive of psoriatic skin lesions: (A) Cornified layer with round to polygonal nucleated bright cells (yellow arrows) corresponding to parakeratotic keratinocytes (RCM image, $500\times 500\ \mu\text{m}$); (B) Clusters of refractile round or elongated structures (white arrow) corresponding to accumulation of infiltrating neutrophils in the parakeratotic areas (white circle) of cornified layer (Munro microabscess) (RCM image, $500\times 500\ \mu\text{m}$); (C) Dark area (yellow asterisk) associated with cluster of refractile round cells (white arrow) in the upper portion of the spinous layer with a relatively bright honeycombed pattern, features suggestive of epidermal spongiosis associated with inflammatory cells (RCM image, $500\times 500\ \mu\text{m}$); (D) Enlarged non-rimmed dermal papillae (white asterisks) with prominent blood vessels (white arrowheads) and with perivascular bright round cells (white arrows) corresponding to inflammatory cells (RCM image, $500\times 500\ \mu\text{m}$); (E) Histopathological image of psoriatic skin showing hyperkeratosis with parakeratosis, acanthosis with regular elongation of the rete ridges and suprapapillary epidermal thinning, moderate inflammatory infiltrate in the papillary and upper reticular dermis (HE staining, $\times 100$); (F) Histological detail showing collections of neutrophils among keratin layers (Munro microabscesses) and enlarged tortuous capillaries in the papillary dermis (HE staining, $\times 200$).

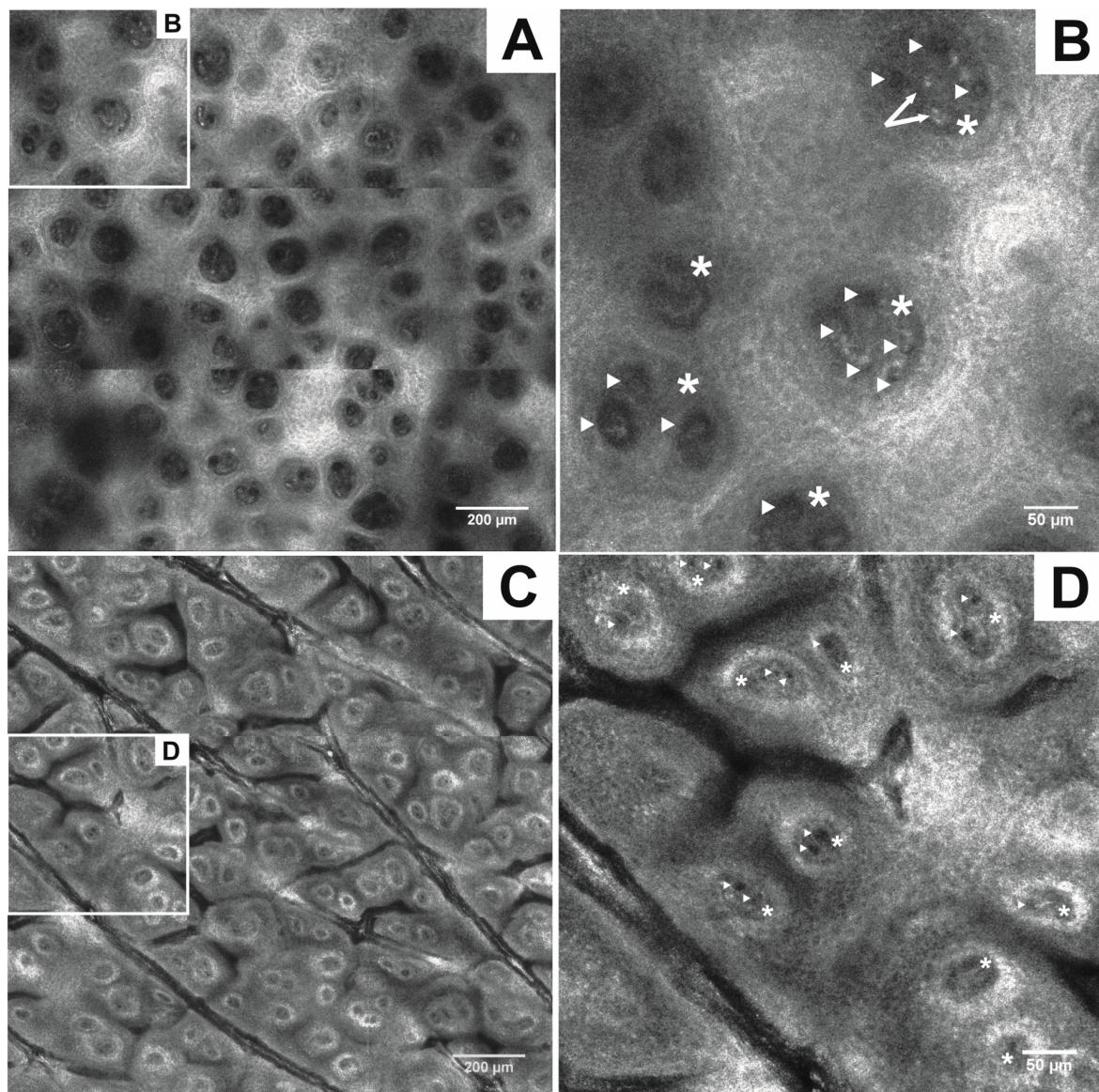


Figure 3 – RCM images of the dermo-epidermal junction from lesional and healthy skin. (A) RCM mosaic of 1.5×1.5 mm from lesional skin revealing enlarged dermal papillae without the bright papillary ring and separated by thinner epidermal tissue; (B) Detail of previous RCM mosaic showing dermal papillae (white asterisks) filled with dilated and tortuous capillaries (white arrowheads) and bright round cells around the enlarged vessels, corresponding to inflammatory cells (white arrows); (C) RCM mosaic of 1.5×1.5 mm from healthy skin showing rimmed dermal papillae with normal diameter; (D) Detail of previous RCM mosaic showing dermal papillae (white asterisks) with small capillary loops visible as dark round structures (white arrowheads).

Discussion

Psoriasis is an inflammatory skin disease, with a polymorphic clinical appearance that often requires a histopathological evaluation to confirm the diagnosis. Modern techniques for *in vivo* imaging of skin structure, such as RCM and dermoscopy, could be very useful tools for diagnosis and monitoring of psoriatic lesions.

In the present case, dermoscopy showed the presence of dotted vessels and superficial white scales regularly distributed over a light red background, previous studies showing that this dermoscopic pattern can reliably predict the diagnosis of psoriasis vulgaris [5, 6, 22, 23, 25, 26].

In vivo RCM allows the non-invasive, high-resolution examination of the skin structure. Recent studies demonstrated that RCM examination allows the identification of the main histological features of psoriatic lesions and

revealed a high degree of correlation between RCM findings and routine histology [5, 7, 17, 29, 30, 35]. In the present case, RCM examination of epidermis showed hyperkeratotic stratum corneum, parakeratosis, accumulation of infiltrating neutrophils in the parakeratotic areas of cornified layer (Munro microabscesses), acanthosis with normal honeycomb pattern of epidermis and reduction/absence of granular layer.

Dermal papillae were visible in the upper part of epidermis corresponding to suprapapillary epidermal thinning. At the dermo-epidermal junction, psoriatic lesion showed the enlargement of dermal papillae compared to uninvolved skin, the tortuosity and enlargement of blood vessels and perivascular inflammatory cell infiltration.

Moreover, RCM revealed some micromorphological aspects without corresponding features in conventional histopathological examination. At the dermo-epidermal

junction, the bright papillary rings of dermal papillae were reduced or absent. Previous studies explained this feature by epidermal hyperproliferation and upward spread of melanocytes [5], inhibition of melanogenesis and/or increased melanocyte apoptosis [16, 36]. Another aspect highlighted only by RCM examination was the presence of dark areas with adjacent clusters of refractile round cells in the upper portion of the spinous layer, described by previous studies as epidermal spongiosis associated with inflammatory cells [16, 36], features suggestive of small spongiform pustules of Kogoj. This might be due to tissue processing and fixation in routine histopathology that could mask the presence of spongiosis [16]. Another explanation is that unlike the vertical sections of conventional histology, the images obtained by RCM are in horizontal plane and allow a full investigation of cutaneous tissue at a given depth in a wide skin area.

Conclusions

Our results highlight the possibility of using modern imaging techniques for *in vivo* diagnosis of psoriasis. There are specific dermoscopic features suggestive for psoriasis and RCM enables identification of most of the histological features of psoriatic lesions, and both dermoscopy and RCM allow a real time non-invasive examination of skin lesions offering the possibility to perform serial determinations.

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Corresponding author

Daniel Boda, MD, PhD, Dermatology Research Laboratory, “Carol Davila” University of Medicine and Pharmacy, 22–24 Grigore Manolescu Street, Sector 1, 0111234 Bucharest, Romania; Phone +40757–079 117, Fax +4021–222 13 10, e-mail: daniel.boda@umf.ro

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