УДК 616.511-02:616-001.17 DOI: 10.22141/2224-1507.10.3.2020.212037

S.A. Trypilka[1], I.Yu. Golovach[2], Ye.D. Yehudina[3]

[1]Municipal Non-Profit Enterprise of Kharkiv Regional Council "Regional Clinical Hospital", Kharkiv, Ukraine
[2]Clinical Hospital "Feofaniya" of the Agency of State Affairs, Kyiv, Ukraine
[3]Clinic of Modern Rheumatology, Kyiv, Ukraine

Clinical case of erythema ab igne caused by the laptop

For citation: Bol', sustavy, pozvonočnik. 2020;10(3):155-160. doi: 10.22141/2224-1507.10.2.2020.212037

Abstract. Erythema ab igne is a localized skin condition involving the reticular hyperpigmentation, epidermal atrophy, and telangiectasias. It is caused by a repetitive and prolonged exposure to a moderate heat or infrared radiation, insufficient for producing burns. At the moment, erythema ab igne is most commonly observed after a repeated use of hot water bottles, infrared lamps, heating pads and heaters. The number of thermal skin lesions is on the increase in young people who, while working, keep the laptop on their hips and knees. For rheumatologists, this pathology may be of clinical interest, since skin alterations may resemble skin lesions attending systemic diseases of the connective tissue. This study presents a case of late diagnosed heat erythema in a young woman due to the laptop use, which resulted in an improper treatment and a large number of unnecessary laboratory and instrumental studies. Late diagnosis is caused by the lack of doctors' awareness of this pathology, which may lead, as in the described case, to an improper treatment and a large number of unnecessary laboratory and instrumental studies.

Keywords: Erythema ab igne, skin lesion, livido, laptop, skin's exposure to heat, clinical case.

Heat erythema (hot water bottle rash, infrared radiation, Erythema ab igne, EAI) is a reticulated erythema, pigmented dermatosis resulting from a multiple effect of moderate heat or infrared radiation. The intensity of infrared radiation causing this condition is not enough to provoke burns. The EAI is also known as "toasted skin syndrome" and "fire stains", a localized skin lesion, reflecting itself by the reticular hyperpigmentation, dark erythema, epidermal atrophy, and telangiectasias [1].

There was time when this condition was associated with people affected by the open fire (oven-based) exposure, most commonly as a professional effect of heat source use by the foundry workers, bakers, or due to the often use of hot water bottles, electric heatpads [2], electric sheets and/or covers, heated car seats [3; 4]. The EAI is provoked by a chronic multiple moderate heat exposure originating from the external heat source. The effect, though not long-lasting, results in a skin hyperthermia within a range of 43-47°C and brings forth certain histopathological changes; similar changes are observed with solar damage. Although the pathogenic EAI mechanisms are under-explored, some studies demonstrate the moderate heat has a synergistic effect with an ultraviolet irradiation, causing the DNA denaturation occurring in the squamous cell carcinomas (SCCs) in vitro [5].

At the moment, this pathology turns into a topical issue among the notebook users, holding computers in the laps [6; 7; 8]. Some notebooks generate some considerable heat, resulting in EAI, when they are held on their knees for a long time [8]. It is true that the powerful processor laptops may get heated up to 50°C and provoke burns [7]. The laptop lying in the user's lap exerts a direct effect via the laptop's heat-up elements, including the central processor and graphic processor. The cooling ventilator being occluded by the user's thighs may increase the laptop's temperature and prevent the free air current. In the review by R.R. Riahi and P.R. Cohen (2012) [7], there are 15 EAI cases described and attributed to the laptop use. Out of 15 patients, 9 cases were women (60%) with a mean age of 25 years at the moment of diagnosis. The men (6 out of 15 patients, 40%) af-

Для корреспонденции: Головач Ирина Юрьевна, доктор медицинских наук, профессор, MBA, заслуженный врач Украины, руководитель центра ревматологии, клиническая больница «Феофания» Государственного управления делами, ул. Академика Заболотного, 21, г. Киев, 03680, Украина; e-mail: golovachirina@gmail.com
For correspondence: Iryna Golovach, MD, PhD, Professor, MBA, Honored Doctor of Ukraine, Head of the Center of rheumatology, Clinical Hospital "Feofaniya" of the Agency of State Affairs, Academic Zabolotny st., 21, Kyiv, 03680, Ukraine; e-mail: golovachirina@gmail.com
Full list of authors information is available at the end of the article.

fected by the laptop-caused erythema had an average age of 20 years at the moment of diagnosis. The duration of laptop use varies from two weeks to two years.

The EAI may occur at various sites, is often asymmetrical and often does not elicit complaints. The early skin lesions disappear spontaneously in a few weeks or months after the heat source is moved away from the skin. Nevertheless, the long-standing lesions may be provoked by the constant hyperpigmentation.

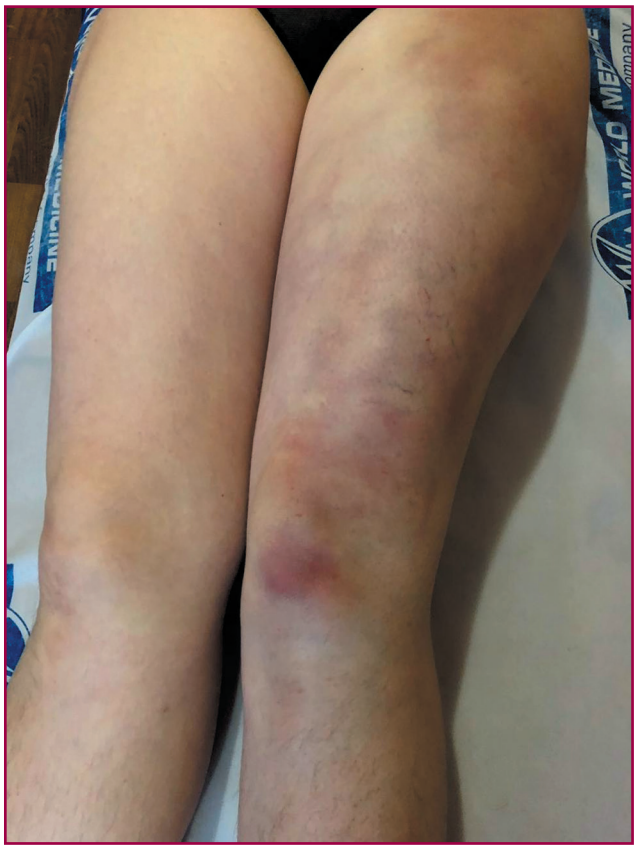

Fig.1. The appearance of patient N.'s skin integument at the moment of rheumatologist's consultation

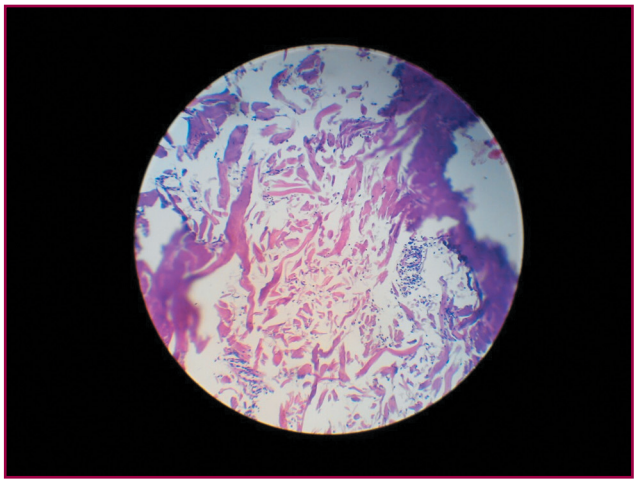

Fig. 2. Histopathological alterations of patient N.'s skin. Minimal alterations of the collagen fibers. The staining by hematoxylin and eosin. × 300

Although the EAI is considered a clinical diagnosis, histological data may significantly assist in a differential diagnosis making, especially when the complicated or dubious cases are involved. The histopathological changes are non-specific [9] and involve epidermal atrophy, hyperkeratosis and parakeratosis, as well as some aspects of lichenification. There are profuse melanophages found in the derma, there are occasional changes of elastic fibers, similar to the actinic elastosis. There are also melanin and hemosiderin deposits and telangiectasia formations, as well as perivascular infiltration of polymorph nuclear cells.

The rheumatologists consider this pathology to be of a clinical interest, as skin conditions may resemble skin lesions attributed to the systemic connective tissue disorders. Following the above-mentioned description, we present the study of EAI case of a young female patient, subject to various examinations intended to ascertain the skin change genesis.

The patient N., 34 years old, complained of consistent skin changes at the site of left thigh and left knee

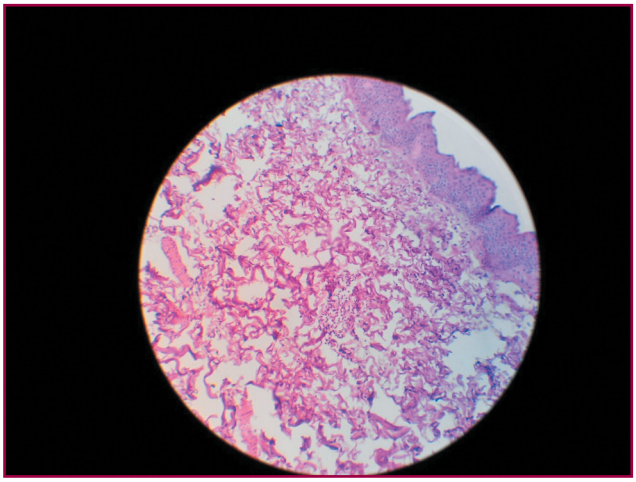

Fig. 3. Histopathological alterations of patient N.'s skin. Minimal alterations of the collagen fibers. The staining by hematoxylin and eosin. × 300

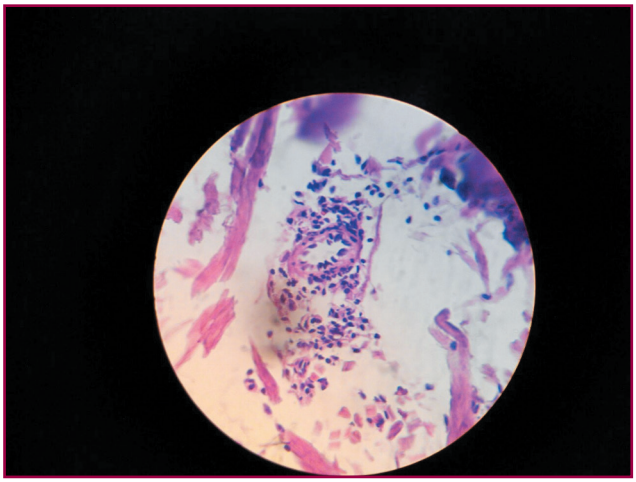

Fig. 4. Histopathological alterations of patient N.'s skin. Perivascular Neutrophils infiltration of the derma. The staining by hematoxylin and eosin. × 300

joint. There were no further complaints. The medical history reveals the gradual increase of changes during the past year. The patient consulted the dermatologist, who recommended a topical glucocorticoid ointment application with no apparent effect; after which, the patient was referred to the vascular surgeon in order to rule out the vascular pathology. There were multiple ultrasound examinations of lower limb vessels, Doppler ultrasonographies. There were no pathological changes found. However, the patient got prescribed a course of monthly treatment by Pentoxifylline, again to no apparent effect. As a result of the absent treatment effect or durable skin changes, the patient was referred to the rheumatologist to discard the diagnoses of vasculitis, scleroderma, systemic lupus erythematosus onset. The rheumatologist interpreted the skin condition as the livedo reticularis, and the patient was screened for the systemic connective disorders.

Based on the examination, her condition was found to be moderately good, the consciousness was clear. The patient was active. The nutrition was moderate: her body mass index was 24.6 kg/m^2. At the left thigh, there were found the sites of reddish-purple hyperpigmentation, indeterminate contours, no pain at palpation, no skin and subcutaneous tissue density compromised. The thigh skin is easily folded. The hyperpigmented sites pale down insignificantly while pressed, after which they return to their initial color (Fig. 1). The peripheral lymph nodes do not increase at palpation. The pulmonary auscultation – in a percutaneous fashion over the whole surface – produces a clear pulmonary sound, there is a vesicular respiration and no rales or crepitations heard. The rate of breathing motions is 17 per minute. The cardiac tones are loud, the action is rhythmic; there is a short systolic noise at the apex, Botkin-Erb's point. The arterial pressure at the right and left arm is 110/80 mm of mercury column; the heart rate is 72 beats per minute, moderately strong, rhythmic. The tongue is moist, clear. The stomach is soft at palpation, palpation produces no pain. The liver, spleen are not augmented. The bladder and bowel habits are regular. No swelling of the lower limbs.

The lab-instrumental examination was performed, involving, along with clinical urine and blood tests, the antinuclear body counts, anti-double stranded DNA (anti-dsDNA) test, as well as skin biopsy of a lesion.

The lab exams showed anemic syndrome, insignificant ESR increase (Table 1).

The screening for the autoimmune conditions did not reveal any disorders found. The cryoglobulins were not counted. The clinical urine tests did not demonstrate any changes. The tests for hepatitis B and C produced negative results. The X-ray examination of chest organs performed at 07.02.2019 did not reveal any pathology.

On 15.01.19, the patient was subjected to the skin biopsy of the anterior left thigh, where a piece of tissue of 13x4x6 mm was extracted (Fig. 2, 3, 4). The study was performed by the anatomic pathologist at the Kharkiv oblast clinical hospital. The study of extracted biopsy material colored by the hematoxylin and eosin stain showed that there were thinned-out sites (atrophies) of epidermis observed, the hyperkeratosis (cornification of the superior layers of the flat cell epithelium) with scaling (peeling) of the cornified cells, parakeratosis occurring in the epidermis (characterized by the nuclear retention in the corneum), vacuole dystrophy of the single keratinocytes; smoothing-down of the dermal papillae, densification of the collagen fibers, interstitial swelling (attributed to the inflammation), expansion of the interdermal vessels, perivascular inflammatory infiltrates containing accumulations of microxyphil leukocytes and mononuclear cells.

Having collected a careful anamnesis of the patient, we found out that during half a year she had a daily working session at home, holding the notebook in her lap whose heat-producing battery was located on the left side. Thus, the patient's left thigh was exposed to a daily dose of heat during half a year. On performing the analysis of that case, results of extra tests and comparing them with the visual alterations and reference data, we made a conclusion that it was the case of a heat erythema or Erythema ab igne.

While analyzing this clinical case, we'd like to draw attention to the following aspects. In the modern society, the long-lasting exposure to the heat produced by the laptops [6; 10] or electric pads [2] turns out one of the commonest cause of heat erythema and inflammation. The patients are often missing these skin lesions due to their asymptomatic character. The data on this condition's prevalence are not found in the reference literature, there are few descriptions of individual cases [7; 8; 11]. However, it became a useful experience obtained through diagnostics and management.

Other conditions similar to Erythema ab igne due to its mesh appearance include livedo reticularis and livedo racemosa, cutis marmorata and congenital cutis mar-

Table 1. Total blood count of the N patient.

Дата	Erythrocytes, x 10^{12}/l	Hb, g/l	Color index	Leukocytes , x 10^9/l	Platelets, x 10^9/l	Stab neutrophils, %	Microxyphils, %	Eosinophils , %	Basophils , %	Lymphocytes , %	Monocytes , %	ESR, mm/hour
30.01.19	3.9	119	0.72	7.3	378	2	55	1	0	38	6	18
06.02.19	3.7	109	0.71	8.2	292	1	49	4	0	37	9	21

Hb – hemoglobin, ESR – erythrocyte sedimentation rate.

morata telangiectatica. The differential distinctions are presented in Table 2.

The skin alterations were initially misinterpreted and treated with topical ointments containing glucocorticoids and vascular medication by Pentoxifylline, entirely inadequate and ineffective for this case. At the further stages, the skin alterations were also misinterpreted as vasculitis signs or the autoimmune connective disorders. The patient had a lot of extra lab studies prescribed, and thus the correct diagnosis was delayed.

The heat erythema is an extremely rare condition, drawing attention both of the rheumatologists and adjunct specialists (dermatologists, vascular surgeons, infectionists and other specialists requesting interpretation of skin alterations). It is associated, on one hand, with a rarity of this pathology, patients consulting dermatologists and vascular surgeons get an ineffective topical or vascular therapy (see above). On the other hand, only a careful anamnesis and analysis of possible associations with heat exposure may help make a correct diagnosis. On the early revelation of this association and eradication of heat exposure, a quick reversible regression of skin alterations with no medical intervention is possible, which is proved by the case of our patients. A long-standing exposure to the heat source may result in an inevitable skin lesion. The reference literature informs of a secondary development of skin malignant neoplasms, such as squamous-cell carcinoma and Merkel's cell carcinoma at the damaged site [12; 13].

The most important treatment method for this pathology is an immediate eradication of heat source. For most cases, the drug treatment is no required. A long-standing exposure associated with a durable hyperpigmentation is effectively treated by Tretinoin and Hydroquinone, or by Fluorouracil (5-FU) [14]. In our case, the heat source eradication provokes a reversible development of skin alterations after two months with a complete disappearance of all symptoms.

This clinical case illustrates an importance of timely awareness-raining and information campaigns for the specialists familiarizing them with a rare pathology in order to ensure a correct approach to the treatment tactics.

Table 2. Differential distinctions of the heat erythema and its clinical imitations

Nosology	Subjects	Clinical manifestations	Localization	Associations	Treatment
Heat erythema (Erythema ab igne)	Most common for the middle-aged or elderly women; the latter facts concern the young people using laptops for work	Localized reticular erythema, correlating with a vascular pattern; turns more cyanotic with time	The skin surface is exposed to the heat source	Due to the chronic heat exposure; the long-standing exposure is associated with squamous-cell carcinoma and Merkel's cell carcinoma	Eradication of heat source or reduction of its use; possible prescription of Fluorouracil (5-FU), positive effect of Tretinoin and Hydroquinone
Livedo reticularis	Young and middle-aged women	Sites of spotty reticular pattern of cyanotic shade, possible hyperpigmentation sites, consistent, symmetrical and reversible	Mostly located on the limbs (preferably thighs)	May be idiopathic, physiological or sign of an anti-phospholipid syndrome	Treatment depends on the cause
Livedo racemosa	Young and middle-aged women	Sites of cyanotic spotty reticular vascular pattern, possible hyperpigmentation sites, consistent character, 'irregular' broken reticular pattern (based on "tree limb" pattern)	Mostly located on the proximal limbs and trunk	May be associated with Sneddon's syndrome, systemic lupus erythematosus, dermatomyositis, anti-phospholipid syndrome	Treatment depends on the cause
Cutis marmorata	Neonates, infants	Wavy, spotty, reticular pattern of hyperpigmentation	Mostly located on the lower limbs	Exposure to the cold temperatures	Warming-up
Cutis marmorata telangiectatica congenita	Neonates	Durable reticular vascular pattern	Mostly located on one limb; if the trunk is involved, there is a common distinct delineation along the median	Congenital disorder associated with a limb asymmetry and vascular malformations, as well as neurological or visual anomalies	Usually improves with time

Conflicts of interests. Authors declare the absence of any conflicts of interests and their own financial interest that might be construed to influence the results or interpretation of their manuscript.

References

1. Kligman LH. Intensification of ultraviolet-induced dermal damage by infrared radiation. Arch Dermatol Res. 1982;272(3-4):229-238. https://doi.org/10.1007/bf00509050.

2. Aria AB, Chen L, Silapunt S. Erythema Ab Igne from Heating Pad Use: A Report of Three Clinical Cases and a Differential Diagnosis. Cureus. 2018;10(5):e2635. https://doi.org/10.7759/cureus.2635.

3. Adams BB. Heated car seat-induced erythema ab igne. Arch Dermatol. 2012;148(2):265-266. https://doi.org/10.1001/archdermatol.2011.2207.

4. Elsner P, Schliemann S. Erythema ab igne as an occupational skin disease (BK 5101). J Dtsch Dermatol Ges. 2014;12(7):621-622. https://doi.org/10.1111/ddg.12303.

5. Roth D, London M. Acridine probe study into synergistic DNA-denaturing action of heat and ultraviolet light in squamous cells. J Invest Dermatol. 1977;69(4):368-372. https://doi.org/10.1111/1523-1747.ep12510247.

6. Guarneri C, Tchernev G, Wollina U, Lotti T, Vaccaro M. Erythema Ab Igne Caused By Laptop Computer. Open Access Maced J Med Sci. 2017;5(4):490-492. https://doi.org/10.3889/oamjms.2017.137.

7. Riahi RR, Cohen PR. Laptop-induced erythema ab igne: Report and review of literature. Dermatol Online J. 2012;18(6):5.

8. Bilic M, Adams BB. Erythema ab igne induced by a laptop computer. J Am Acad Dermatol. 2004;50(6):973-974. https://doi.org/10.1016/j.jaad.2003.08.007.

9. Cavallari V, Cicciarello R, Torre V, et al. Chronic heat-induced skin lesions (erythema ab Igne): ultrastructural studies. Ultrastruct Pathol. 2001;25(2):93-97. https://doi.org/10.1080/01913120117614.

10. Salgado F, Handler MZ, Schwartz RA. Erythema ab igne: new technology rebounding upon its users?. Int J Dermatol. 2018;57(4):393-396. https://doi.org/10.1111/ijd.13609.

11. Beleznay K, Humphrey S, Au S. Erythema ab igne. CMAJ. 2010;182(5):E228. https://doi.org/10.1503/cmaj.081216.

12. Sigmon JR, Cantrell J, Teague D, Sangueza O, Sheehan DJ. Poorly differentiated carcinoma arising in the setting of erythema ab igne. Am J Dermatopathol. 2013;35(6):676-678. https://doi.org/10.1097/dad.0b013e3182871648.

13. Jones CS, Tyring SK, Lee PC, Fine JD. Development of neuroendocrine (Merkel cell) carcinoma mixed with squamous cell carcinoma in erythema ab igne. Arch Dermatol. 1988;124(1):110-113. http://doi.org/10.1001/archderm.1988.01670010074024.

14. Tan S, Bertucci V. Erythema ab igne: an old condition new again. CMAJ. 2000;162(1):77-78.

Received 19.05.2020
Revised 01.06.2020
Accepted 13.06.2020

Information about authors

S.A. Trypilka, MD, PhD in medicine, Associate of Professor, Rheumatologist of Communal Non-Commercial Enterprise of Kharkiv Regional Council "Regional Clinical Hospital", Kharkiv, Ukraine; ORCID iD: https://orcid.org/0000-0001-6630-9893

I.Yu. Golovach, MD, PhD in medicine, professor, Head of the Center of rheumatology, Clinical Hospital "Feofaniya" of the Agency of State Affairs, Kyiv, Ukraine, e-mail: golovachirina@gmail.com; phone +380506542188; ORCID iD: https://orcid.org/0000-0002-6930-354X

Ye.D. Yehudina, MD, PhD, professor, Head of the Educational Center, Clinic of Modern Rheumatology, Kyiv, Ukraine; ORCID iD: https://orcid.org/0000-0001-8702-5638

Трипілка С.А.[1], Головач І.Ю.[2], Єгудіна Є.Д.[3]

[1]Комунальне некомерційне підприємство Харківської обласної ради «Обласна клінічна лікарня», м. Харків, Україна

[2]Клінічна лікарня «Феофанія» Державного управління справами, м. Київ, Україна

[3]Клініка сучасної ревматології, м. Київ, Україна

Клінічний випадок теплової еритеми (Erythema ab igne), викликаної використанням ноутбука

Резюме. Теплова еритема (Erythema ab igne) — це локалізоване шкірне захворювання, що проявляється ретикулярною гіперпігментацією, темною еритемою, епідермальною атрофією та телеангіектазіями. Її виникнення викликано повторюваним і тривалим впливом помірного тепла або інфрачервоного випромінювання, якого недостатньо для отримання опіків. На сьогодні теплова еритема найчастіше спостерігається після багаторазового використання грілок, інфрачервоних ламп та обігрівачів. Останнім часом збільшилася кількість теплових уражень шкіри в молодих людей, які під час роботи тримають ноутбук на стегнах і колінах. Для ревматологів дана патологія може становити клінічний інтерес, оскільки шкірні зміни можуть нагадувати ураження шкіри при системних захворюваннях сполучної тканини. Поданий опис клінічного випадку пізньої діагностики теплової еритеми в молодої жінки внаслідок роботи з ноутбуком, що призвело до неправильного лікування і великої кількості непотрібних лабораторних та інструментальних досліджень. Пізня діагностика обумовлена недостатньою поінформованістю лікарів про дану патологію, що може призводити, як в описаній нами ситуації, до неправильного лікування і великої кількості непотрібних лабораторних та інструментальних досліджень.

Ключові слова: теплова еритема; ураження шкіри; ліведо; ноутбук; вплив тепла на шкіру; клінічний випадок

Триполка С.А.[1], Головач И.Ю.[2], Егудина Е.Д.[3]
[1]Коммунальное некоммерческое предприятие Харьковского областного совета «Областная клиническая больница», г. Харьков, Украина
[2]Клиническая больница «Феофания» Государственного управления делами, г. Киев, Украина
[3]Клиника современной ревматологии, г. Киев, Украина

Клинический случай тепловой эритемы (Erythema ab igne), вызванной использованием ноутбука

Резюме. Тепловая эритема (Erythema ab igne) — это локализованное кожное заболевание, проявляющееся ретикулярной гиперпигментацией, темной эритемой, эпидермальной атрофией и телеангиэктазиями. Она вызвана повторяющимся и длительным воздействием умеренного тепла или инфракрасного излучения, которого недостаточно для получения ожогов. В наши дни тепловая эритема чаще всего наблюдается после многократного использования грелок, инфракрасных ламп и обогревателей. В последнее время увеличилось число тепловых поражений кожи у молодых людей, которые во время работы держат ноутбук на бедрах и коленях. Для ревматологов данная патология может представлять клинический интерес, поскольку кожные изменения могут напоминать поражения кожи при системных заболеваниях соединительной ткани. Представлено описание клинического случая поздней диагностики тепловой эритемы у молодой женщины вследствие работы с ноутбуком. Поздняя диагностика обусловлена недостаточной информированностью врачей о данной патологии, что может приводить, как в описанной нами ситуации, к неправильному лечению и большому количеству ненужных лабораторных и инструментальных исследований.

Ключевые слова: тепловая эритема; поражение кожи; ливедо; ноутбук; воздействие тепла на кожу; клинический случай