

Erythema *ab igne* induced by a laptop computer in an adolescent^{*}

Eritema *Ab Igne* em adolescente induzido por computador laptop

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Abstract: Erythema *ab igne* is a pigmented reticular skin lesion with telangiectasias caused by prolonged exposure to heat. This report describes the case of a 12-year-old adolescent girl with erythema *ab igne* induced by a laptop computer. The paper also discusses how computers generate heat and how important it is for the manufacturers of these devices to warn consumers of the potential hazards that could occur if the equipment is misused.

Keywords: Computers, Erythema, Radiation Effects

Resumo: O eritema *ab igne* é lesão de pele reticular pigmentada com telangiectasias, causada pela exposição prolongada ao calor. Relatamos o caso de uma adolescente de 12 anos de idade com eritema *ab igne* produzido por computador laptop. É discutido como os computadores geram calor e a importância da notificação pelos fabricantes da possibilidade de aparecimento desta dermatose nos usuários de computadores portáteis.

Palavras-chave: Computadores, Efeitos de Radiação, Eritema

INTRODUCTION

Erythema *ab igne* is described as a pigmented reticular skin lesion with telangiectasias that occurs as a result of prolonged exposure to heat. Currently, the development of new technology in the form of portable computers and accessories means that these devices may be in direct contact with the user's skin for prolonged periods of time, consequently causing damage to the skin. This paper reports the case of an adolescent girl with erythema *ab igne* resulting from the use of a laptop computer.

CASE REPORT

A 12-year old female patient from Curitiba, Paraná, skin phototype II, complained of an extensive violaceous mark on the dorsal surface of both thighs that had been present for the past 8 months. The mark was more intense on her right thigh. Later, the

violaceous mark turned a brownish color. The patient was asymptomatic.

At dermatological examination, 20-cm brownish macules were found on the anterior surface of the patient's thighs, with mild erythema along the edges. The lesion was affecting both thighs, but was more visible on the dorsal surface of the right thigh (Figures 1 and 2). The site affected by the marks appeared hotter to the touch compared to the normal, lesion-free skin. Dermoscopy showed the presence of homogeneous, brownish pigmentation with erythema at the edges of the macules. The other tests carried out, including full blood count, C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR), were all within the normal range. A biopsy was performed on the lesion located on the dorsal surface of the patient's right thigh and on a sample of her normal

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FIGURE 1: Brownish macules with erythema on the edges of the anterior surface of the thighs



FIGURE 2: Lesions on the right thigh

skin for comparison. When questioned, the patient reported that around 11 months previously she had developed the habit of resting her laptop on her thighs and would spend several hours a day working in that position (Figure 3).

The patient was advised not to place her laptop computer directly on her thighs but had to use a table or another type of support to diminish the possibility of direct contact with the device and to use local photoprotection. The patient was reevaluated ten days later and the brownish macules were found to be gradually disappearing. Anatomopathology revealed skin with moderate acanthosis, the basal layer unaffected and scanty perivascular lymphocytic inflammatory infiltrate compatible with erythema *ab igne*.

DISCUSSION

Erythema *ab igne* is defined as a pigmented or unpigmented reticular skin lesion with telangiectasias resulting from prolonged and repeated exposure to moderate heat.^{1,2} Infrared radiation (which produces heat) is insufficient to cause a burn.¹ Erythema *ab igne* is also known as erythema *a calore*.² It has been reported in individuals who use hot water bottles for warmth in winter or repeated hot compresses and in patients who strongly prefer warm environments.¹ It is found more commonly on women's legs,¹ but may also be seen on the buttocks and thighs.³ The possibility of hypothyroidism with hypothermia must be eliminated.^{1,2} The pathogenesis of the condition is unknown.² The lesions are found at sites exposed to infrared radiation and in the borders of areas in which items of clothing and skin overlap, leaving certain areas more or less exposed to radiation.¹ Differential diagnosis should be made with poikiloderma, sun damage (actinic keratosis), livedo reticularis or vas-

culitis.¹ In the initial stages, histopathology reveals epidermal atrophy, dermal pigmentation and vasodilation.¹ When chronic, the collagen bands may become fragmented, smaller and thicker, with a loss of basement membrane collagen IV.^{1,3} The following complications may develop: the presence of blisters, atrophy, residual hyperpigmentation, keratoses and squamous cell carcinoma *in situ*.¹ Rarely, in the form of the Koebner phenomenon, psoriasis, lichen planus and lupus may develop at the site of erythema *ab igne*.¹ Treatment involves eliminating direct contact between the skin and the source of infrared radiation, photoprotection of the site in cases of sun exposure and 5% fluorouracil cream if keratoses are present at the site. 1 Some cases of erythema *ab igne* on the dorsal surface of the thighs resulting from the use of a laptop computer have been reported in the literature.^{2,4-6}



FIGURE 3: Demonstration of how the patient used the laptop directly on top of her thighs

Four of these cases occurred in women and one in a male.⁷ The case reported here is the second case in the literature dealing with an adolescent.

The cause of erythema *ab igne* on the dorsal surface of the thighs resulting from the use of a laptop computer is the direct contact with the infrared radiation produced from heat generated by the computer on the skin. The temperature required to induce erythema *ab igne* ranges from 43 to 47°C.¹

The principal components that contribute towards the heat generated by a computer are the integrated circuits of the device such as the central processing unit (CPU) and the graphics processing unit (GPU). This occurs because electrical currents have to cross each other in order for the devices to function. The frequency and voltage of these currents determine the amount of heat they generate.⁸ For these devices to function correctly, they must not overheat; therefore the heat generated has to be allowed to dissipate. There are two ways of cooling computers. The first is air cooling. This consists of the use of various fans that draw cool air from the environment and circulate it through the components of the computer, absorbing the heat generated by them and expelling it. The second form of cooling is

by submersion in liquid. With this technique, the components of the computer are submersed in a thermally conductive liquid. Cooling occurs through the passive exchange of heat between the devices and the liquid and between the liquid and room air. Nevertheless, this liquid has to also be a poor conductor of electricity so that it will not affect the normal functioning of the computer components.⁸

In laptop computers, as in the vast majority of personal computers, cooling is achieved through the use of fans. The available space for these devices inside a laptop computer is much smaller compared to that of a desktop; therefore, the fan may jam much more easily due to an accumulation of dust, or the tiny space through which the air enters may become obstructed by small objects. This may cause overheating to occur in the computer's components, leading to erythema *ab igne* if the computer is being supported on the user's thighs.

We would suggest that computer manufacturers should be informed of the possibility of this type of skin lesion if the computer comes into direct contact with the skin and that consumers should be warned in the instruction manual of the device. □

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