

Cutaneous Manifestations of Modern Technology Use

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Background: Modern-age technology is increasingly implicated in traditional dermatologic conditions.

Objective: This review provides a concise overview of the cutaneous manifestations from modern technology use.

Methods: We describe a case of laptop computer-induced erythema ab igne and provide a review of the literature pertaining to the etiology, clinical features, diagnosis, and management of reported cases of dermatoses resulting from the use of modern technology.

Results: Sources of modern technology implicated in the reported cases include video games, laptop computers, personal computers and accessories, and smart and cellular phones. These presentations have primarily been localized to the extremities, particularly the hands and face. Diagnoses were associated with trauma or repetitive strain, irritant contact dermatitis, or allergic contact sensitivities. Removal of the offending agent was most often described as effective in symptom resolution.

Conclusion: It is important to consider modern-age sources as part of the index of suspicion for diagnosing traditional dermatologic conditions. These manifestations will likely increase over time with the pervasive popularity and use of modern technology. Early recognition of the offending agent will be beneficial in differentiating the etiology for effective management.

Renseignements généraux: La technologie moderne est de plus en plus en cause dans les pathologies dermatologiques classiques.

Objectif: Cet examen offre une vue d'ensemble précise des manifestations cutanées causées par l'utilisation de la technologie moderne.

Méthodes: Nous décrivons un cas d'érythème *ab igne* causé par les radiations caloriques des ordinateurs portatifs, ainsi qu'un examen de la documentation qui porte sur l'étiologie, le profil clinique, le diagnostic, et la prise en charge des cas de dermatose signalés, découlant de l'utilisation de la technologie moderne.

Résultats: Les sources de radiations en cause dans les cas signalés comprennent les jeux vidéo, les ordinateurs portatifs, les ordinateurs personnels, et les accessoires, ainsi que les téléphones intelligents et les téléphones cellulaires. Ces manifestations ont été localisées surtout aux extrémités, en particulier les mains et le visage. Les diagnostics ont été associés à un traumatisme ou une tension répétitive, à une dermatite de contact irritante, ou à des sensibilités de contact allergique. On a très souvent indiqué que le retrait des agents en cause suffisait à résorber les symptômes.

Conclusion: Il est important de considérer que les sources de radiations liées à la technologie moderne font partie de l'indice de suspicion pour diagnostiquer les pathologies dermatologiques classiques. Ces manifestations augmenteront probablement au fil du temps avec la popularité envahissante et l'utilisation de la technologie moderne. La reconnaissance rapide des agents en cause sera utile pour distinguer l'étiologie en vue d'une prise en charge efficace.

WITH AN ALMOST UNIVERSAL AVAILABILITY of modern-day personal technology, cutaneous manifestations arising from its use are increasingly presented to physicians, particularly dermatologists. Technology, including personal and laptop computers, cellular and smart

phones, and video consoles, has been implicated as the modern cause of traditional dermatologic conditions. These presentations have primarily been localized to the extremities, particularly the hands and face. To date, a handful of case reports have described such cutaneous diagnoses. We present a case of erythema ab igne secondary to laptop computer use and review the dermatoses of modern-age technology to provide more insights into these phenomena.

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Case Report

A 24-year-old previously healthy woman presented with an asymptomatic, reticulated, erythematous to dull brown

pattern on her anterolateral thighs (Figure 1). Questioning by the dermatologist revealed that the patient had used a new laptop computer for the past 9 months, with onset of discoloration 3 months ago. These findings were consistent with a clinical diagnosis of erythema ab igne. The patient was advised to avoid placing the computer on her thighs and was informed that the discoloration would likely improve with time. The patch gradually faded over 9 months.

Literature Review

We performed a literature review on cutaneous presentations associated with the use of modern technology, including personal digital assistants, laptop and personal computers, video games, cellular phones, and related terms. A comprehensive search for English-language articles was conducted in four databases: *Ovid MEDLINE* (1950 to week 4, May, 2010), *MEDLINE* in process and other nonindexed citations (until May 31, 2010), *EMBASE* (1980 to week 22, 2010), and *PubMed*. Bibliographies of all included studies were also reviewed to retrieve additional papers not identified through the database searches. In each electronic database, relevant MeSH terms and terms identified by included articles were used.

Discussion

Search results were categorized under one of four categories: (1) video games, (2) cellular and smart phones, (3) laptop computers, and (4) personal computers and computer accessories. Table 1 is a summary for approaching



Figure 1. Laptop computer–induced erythema ab igne on the right thigh.

dermatologic conditions secondary to use of modern-age technology.

Video Games

PlayStation Thumb

One study described “PlayStation thumb” occurring from repetitive strain injury with excessive video game playing.¹ The 29-year-old man developed pain and blisters in the thumb and presented with hyperkeratosis of the digit with posttraumatic punctate hemorrhagic suffusions seen by dermoscopy. These features likely appeared from extravasation of blood into the stratum corneum from rupturing of papillary vessels. The patient also had an area of onycholysis overlying hyperkeratosis at the fingernail plate. All of the lesions resolved within 3 weeks after avoidance of PlayStation use.

PlayStation Palmar Hidradenitis

One study reported a previously healthy 12-year-old girl presenting with acute onset of intensely painful lesions isolated to the palms of both hands.² Erythematous, firm and tender nodules developed on the palmar side of the first metacarpophalangeal joints, on the thenar and hypothenar prominences of the left hand, and on the distal phalanges of the thumb and fifth digit of the right hand. Histopathology revealed neutrophilic infiltration of eccrine sweat glands consistent with idiopathic eccrine hidradenitis. The lesions had developed following continuous trauma to the palmar surfaces from tight hand grips and repeated pushing of buttons on the PlayStation controller. Complete resolution of the palmar hidradenitis was achieved with cessation of video game playing for 10 days.

Table 1. Approach to Modern-Age Dermatoses

Source
Video games (eg, PlayStation)
Laptop computers
Personal computers and accessories (mouse, wrist rest)
Personal digital assistants (eg, BlackBerry) and cellular phones
Treatment
Cessation of causative agent for all sources
Topical tretinoin or modified Kligman formulation for persistent hyperpigmentation for erythema ab igne
Keratolytics (eg, urea 40% cream) for hyperkeratosis
Moderate-potency topical corticosteroid for hyperkeratosis

Table 2. Characteristics of Patients with Cellular Phone Dermatitis

<i>Study</i>	<i>Patient(s)</i>	<i>Presentation</i>	<i>Patch Test Results</i>
Thyssen et al ³¹	28-year-old female	Nummular dermatitis on left cheek	Positive for nickel; strongly positive DMG test
Wohrl et al ⁷	19-year-old female	Nickel dermatitis on both hands, lower arms, right preauricular skin, umbilicus	+++ reaction (D2, D3) to nickel; positive DMG test
Seishima et al ⁸	14–54 years old: 4 females and 4 males	Erythema, papules on hemilateral auricle or preauricular areas	All patients: ++ or + for 0.5%, 0.1%, 0.05% potassium dichromate; 1 patient: + for 2% cobalt chloride; 1 patient: + for 5% nickel sulfate
Seishima et al ⁸	35-year-old female	Pruritic papules, erythema on preauricular area of left cheek	++ for 0.5%, 0.1%, 0.05% potassium dichromate
Madhukara et al ⁹	32-year-old male	Unilateral, well-defined erythematous, eczematous area in preauricular area	++ for nickel
Luo and Bercovitch ³²	18-year-old male	Pruritic, lichenified plaques on lower abdomen Eczematous plaques on extremities, flanks, face	Positive for nickel (at 72 hours)
Livideanu et al ⁶	25-year-old female	Excoriated, erythematous facial papular lesions bilaterally	5% nickel sulfate (++/++ at D2, D3); positive nickel spot test with DMG
Lee and Yang ³⁴	3 patients (age and gender not reported)	Erythematous papules/patches in preauricular area	Positive for nickel, cobalt
Guarneri et al ³⁵	38-year-old male	Intensely pruritic eczematous patch on anterolateral aspect of both thighs	Nickel sulfate (+++ on D2 and D4); positive DMG test

A positive dimethylglyoxime (DMG) test indicating nickel release of $> 0.5 \mu\text{g}/\text{cm}^2$ per week.

Frictional Hyperkeratosis (Callus)

One study described a 13-year-old boy with a knuckle pad, also known as subcutaneous fibroma, on the right second distal interphalangeal joint following repetitive trauma to the hands and fingers from playing video games.³ The child had held the video game controller against the lateral area of the second digit, and the thumb forced the controller against the proximal interphalangeal and distal interphalangeal joints with each push of the buttons. The lesion was a firm, fibrous plaque that was freely movable but asymptomatic.⁴ Punch biopsy revealed hyperkeratosis and acanthosis. Reduction of video game play along with application of 40% urea cream twice daily as a keratolytic led to resolution of the lesion.

Mobile Phones

Cellular Phones

Nickel and chromium dermatitis, most commonly affecting the face, have been described in a number of cases following prolonged exposure to cellular phones.^{5–8} Sites involved include the cheek and preauricular region. Of all

contact allergens, nickel is the most commonly reported, with a sensitization rate up to 28.4% among young adults.^{9,10} Our literature review yielded 19 cases of cellular phone-related dermatitis, which are summarized in Table 2.

Smart Phones (eg, BlackBerry)

Three case reports have described cutaneous manifestations following use of a smart phone or personal digital assistant (PDA).^{11,12} In these reports, the distal components of the thumb were involved, corresponding with typical use of the device.¹¹ In one case, a 48-year-old female with metastatic colorectal cancer in a trial of single-agent sunitinib, developed symmetric hyperkeratosis with an erythematous halo on the tips of her thumbs and index fingers that caused persistent pain and discomfort.¹¹ It was believed that pressure from the use of her BlackBerry may have ruptured capillaries in the affected digits and caused a direct inflammatory reaction from increased, local delivery of the chemotherapeutic drug. The PDA-induced lesions, secondary to sunitinib, resolved with avoidance of vigorous digital activity, use of hand gloves, and application of urea 40% cream to thin the epidermis so that pressure was minimized on dermal capillaries per unit area.

Traumatic thumb nail dystrophies have also been described in two patients.¹² Following 4 to 8 months of habitual PDA use, medial nail dystrophy was noted owing to repeated pressure for several hours each day. One patient developed thumb nail psoriasis and paronychia. Analysis of nail biomechanics in these patients demonstrated that maximal stress was greatest at the root of internal nail surfaces. These symptoms all resolved completely following cessation of PDA use.

Laptop Computers

Erythema Ab Igne

Historically, erythema ab igne (EAI) is a reticular, telangiectatic, pigmented dermatosis resulting from chronic exposure to heat that is insufficient to cause a burn.^{13–16} Individuals who were previously affected worked in front of open fires or coal stoves or were silversmiths and jewelers who were chronically exposed to moderate infrared radiation.^{16–19} As time evolved, EAI began reappearing in those using local heating sources such as heating pads and hot water bottles to treat abdominal and chronic back pain at home.^{15,16,20–23}

Laptop-induced EAI was first described only recently in 2004.^{17,21} To date, only six cases have been reported, with exposure from 2 weeks to several months.^{17–19,21,24,25} (Table 3). It is likely that these cases will increase with the growing popularity and use of laptop computers.

Clinically, EAI is diagnosed based on the history and the distribution and distinctive cutaneous changes from thermal exposure.²³ The etiopathogenesis is unknown,¹⁹ although lesions appear to result from cumulative

exposure rather than length of exposure.¹⁶ A biopsy is often not required unless malignant changes are suspected.²³ These include squamous and Merkel cell carcinomas, although typically after decades of heat exposure.²² Differential diagnoses, including livedo reticularis, cutis marmorata, nevus flammeus, and poikiloderma, may need to be considered.

In contrast to other heat sources, cutaneous malignancies have not been reported in laptop-induced EAI to date. Cessation of laptop use on body surfaces, typically the thighs, appears to be a simple but effective treatment.^{18,19,23}

Personal Computer and Computer Accessories

Allergic Contact Palmar Dermatitis

Contact dermatitis secondary to computer components is most likely caused by plastic and rubber.²⁶ Sources included mouse pads, keyboard wrist rests/pads, and computer mice. The first case report, a patient with documented rubber sensitivity, described an acute vesicular and eczematous reaction from exposure to a keyboard wrist pad containing neoprene.²⁷ Other cases that have since been described are summarized in Table 4.

In all patients, erythematous patches and plaques developed with or without vesicular eruptions. As in many instances of occupational contact dermatitis, thiourea and its rubber derivatives, as well as plasticizers such as phthalates, were frequently implicated in reported cases.^{26,28} Phthalates, which increase the flexibility of plastics, may be a component in as much as 50% of the final product.²⁸

Table 3. Characteristics of Laptop-Induced Erythema Ab Igne

Study	Patient	Presentation	Outcome
Bilic and Adams ¹⁷	50-year-old male	Asymptomatic, well-demarcated, erythematous, reticulated brown patch on thighs bilaterally and evenly	Not described
Jagtman ²¹	48-year-old female	Asymptomatic, reticulated, pigmented patch, right > left thigh, corresponding to warmer part of laptop	Not described
Maalouf et al ¹⁹	17-year-old female	Asymptomatic, reticulated, mildly erythematous, brown patch, left > right thigh, corresponding to warmer part of laptop	Cessation of laptop use on thigh; EAI resolved completely in 2 months
Bachmeyer et al ¹⁸	26-year-old man	Asymptomatic, reticulated, macular, brown pigmentation, right > left thigh, corresponding to warmer part of laptop	Cessation of laptop use on thigh; EAI progressively cleared within 3 months

EAI = erythema ab igne.

Table 4. Manifestations of Personal Computer–Related Dermatoses

<i>Allergen</i>	<i>Patient</i>	<i>Presentation</i>	<i>Patch Test Result</i>	<i>Outcome</i>
Wrist rest of computer ²⁶	29-year-old female	Hyperkeratosis, erythema of palms bilaterally × 8 years	+++ to dialkyl thiourea	1. Avoided wrist rest 2. Use of fluocinonide (dosage not reported) 3. Vinyl glove occlusion—80% of lesions resolved over 8 weeks
Keyboard wrist pad ³⁶	25-year-old female	Symmetrical, erythematous, hyperkeratotic plaques with vesicles on palms bilaterally (length of symptom not reported)	Positive imidazolidinyl urea 2% aq (aqueous solution), mixed dialkyl thioureas 1% pet (petroleum solution), fragrance mix 8% pet, thimerosal 0.1% pet	1. Discarded wrist pad 2. Use of betamethasone dipropionate ointment (twice daily × 3 weeks to once daily × 2 weeks)—lesions resolved completely
Keyboard wrist pad ³⁰	Case 1: 34-year-old female Case 2: 40-year-old male	Case 1: asymptomatic, well-demarcated, knuckle pad on ulnar side of left wrist × 2 months Case 2: asymptomatic knuckle pad on ulnar side of right wrist (length of symptom not reported)	Case 1: no patch result Case 2: no patch result	Soft cushion material under wrists Case 1: female improved at 3 months Case 2: male unchanged at 6 months
Computer mouse pad ³⁷	57-year-old male	Sharply demarcated, erythematous, scaling eruption on palmar aspect of right thumb × 7 months	++ to fragrance mix; +++ to diphenylthiourea; +++ to 2,6-di-tert-butyl-4-cresol; ++ zinc dibutylthiocarbamate	Avoided use of mouse pad Dermatitis improved within 7 days
Computer mouse ²⁸	Case 1: 22-year-old female Case 2: 34-year-old female	Case 1: evolving eczema on right hand + erythematous, vesicular palmar lesions × 6 months Case 2: scaly, erythematous lesions on right hand	Case 1: ++ for diethyl phthalate (5% pet) Case 2: ++ to dimethyl phthalate (5% pet)	Cover on mouse Cases 1 and 2: lesions resolved completely
Computer mouse ³⁸	39-year-old female	Scaly, hyperkeratotic, fissured eczema on palmar side of right hand × 6 months	++ to nickel, ++ to balsam of Peru, ++ to benzoyl peroxide, ++ to resorcinol monobenzoate	Cessation of use of implicated computer Lesions resolved completely
Keyboard wrist pad (containing neoprene) ²⁷	43-year-old female	Vesicles on palmar surface of distal wrist × 2 days; pruritic, scaly, erythematous patches on arms, legs, face with mild periorbital swelling × 5 days	++ to mercapto, thiuram mixes; + to balsam of Peru	3-week tapering dose of prednisone (60, 40, 20 mg) with avoidance of rubber/neoprene products Lesions resolved (at 1- and 3-month follow-up)

Conclusion

Rubber additives, such as thiuram and thiourea, are typical sources of allergic contact dermatitis.²⁹ Such additives are found in modern technology sources such as mouse pads, computer mice, and keyboard wrist pads.^{27,28,30} Allergic reaction to a variety of computer accessories can be

attributed to phthalates and similar derivatives that are added to increase malleability in plastic products.

Patient education on the potential carcinogenicity of chronic heat exposure may help prevent its cutaneous presentation. Although malignancies have not been described to date in laptop-induced EAI, their potential warrants caution. Using laptop computers on solid

surfaces rather than body surfaces, such as the thighs, can be advised by both dermatologists and laptop manufacturers.^{18,19}

Greater caution in diagnosis may be exercised in patients who are suspected of being or already are nickel sensitized.³¹ Performing dimethylglyoxime spot testing, which is practical, reliable, and inexpensive, may be recommended to such patients on common sites of nickel sources such as menu buttons, decorative logos on headsets, and metallic frames around display screens prior to purchase of a new cellular phone.³²

With increasing reports, it may be useful to consider modern-age sources as part of the index of suspicion for diagnosing traditional dermatologic conditions. Important features to elicit may include the duration and amount of exposure, previous sensitivities to allergens tracing to childhood, and posturing or habits with use that may produce friction or repetitive strain.³³ For all cutaneous manifestations induced by modern-age sources, cessation of use is a sensible and often most effective treatment. The prognosis is excellent with early removal of the offending agent.

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