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.

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**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.

**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 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. 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. 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

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

### Table 2. Characteristics of Patients with Cellular Phone Dermatitis

<table>
<thead>
<tr>
<th>Study</th>
<th>Patient(s)</th>
<th>Presentation</th>
<th>Patch Test Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thyssen et al31</td>
<td>28-year-old female</td>
<td>Nummular dermatitis on left cheek</td>
<td>Positive for nickel; strongly positive DMG test</td>
</tr>
<tr>
<td>Wohrl et al7</td>
<td>19-year-old female</td>
<td>Nickel dermatitis on both hands, lower arms, right preauricular skin, umbilicus</td>
<td>+++ reaction (D2, D3) to nickel; positive DMG test</td>
</tr>
<tr>
<td>Seishima et al8</td>
<td>14–54 years old: 4 females and 4 males</td>
<td>Erythema, papules on hemilateral auricle or preauricular areas</td>
<td>All patients: ++ or + for 0.5%, 0.1%, 0.05% potassium dichromate; 1 patient: + for 2% cobalt chloride; 1 patient: + for 5% nickel sulfate</td>
</tr>
<tr>
<td>Seishima et al8</td>
<td>35-year-old female</td>
<td>Pruritic papules, erythema on preauricular area of left cheek</td>
<td>++ for 0.5%, 0.1%, 0.05% potassium dichromate</td>
</tr>
<tr>
<td>Madhukara et al9</td>
<td>32-year-old male</td>
<td>Unilateral, well-defined erythematous, eczematous area in preauricular area</td>
<td>++ for nickel</td>
</tr>
<tr>
<td>Luo and Bercovitch32</td>
<td>18-year-old male</td>
<td>Pruritic, lichenified plaques on lower abdomen Eczematous plaques on extremities, flanks, face</td>
<td>Positive for nickel (at 72 hours)</td>
</tr>
<tr>
<td>Livideanu et al8</td>
<td>25-year-old female</td>
<td>Excoriated, erythematous facial papular lesions bilaterally</td>
<td>5% nickel sulfate (++/+ at D2, D3); positive nickel spot test with DMG</td>
</tr>
<tr>
<td>Lee and Yang34</td>
<td>3 patients (age and gender not reported)</td>
<td>Erythematous papules/patches in preauricular area</td>
<td>Positive for nickel, cobalt</td>
</tr>
<tr>
<td>Guarneri et al55</td>
<td>38-year-old male</td>
<td>Intensely pruritic eczematous patch on anterolateral aspect of both thighs</td>
<td>Nickel sulfate (+++ on D2 and D4); positive DMG test</td>
</tr>
</tbody>
</table>

*A positive dimethylglyoxime (DMG) test indicating nickel release of > 0.5 μg/cm² per week.*

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. 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. 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. 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.

Laptop-induced EAI was first described only recently in 2004. To date, only six cases have been reported, with exposure from 2 weeks to several months (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. The etiopathogenesis is unknown, although lesions appear to result from cumulative exposure rather than length of exposure. A biopsy is often not required unless malignant changes are suspected. These include squamous and Merkel cell carcinomas, although typically after decades of heat exposure. 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.

**Personal Computer and Computer Accessories**

*Allergic Contact Palmar Dermatitis*

Contact dermatitis secondary to computer components is most likely caused by plastic and rubber. 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. 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. Phthalates, which increase the flexibility of plastics, may be a component in as much as 50% of the final product.

### Table 3. Characteristics of Laptop-Induced Erythema Ab Igne

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

EAI = erythema ab igne.
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

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

### Table 4. Manifestations of Personal Computer–Related Dermatoses

**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.
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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References


