

Allergic Contact Dermatitis: Early Recognition and Diagnosis of Important Allergens

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Allergic contact dermatitis (ACD) is an important disease with high quality of life and economic impact. Patch testing is the procedure by which identification of the cause of ACD can be elicited. Proper performance of the test, from taking an appropriate patient history to placing the correct allergens to evaluating and educating the patient, is of utmost importance. The purpose of this article is to highlight common allergens encountered in our environment, to increase awareness for this important disease, and to underscore the importance of this testing modality. An early index of suspicion can lead to appropriate testing, diagnosis, avoidance, and cure.

Allergic contact dermatitis (ACD) is a commonly seen ailment of patients visiting general medical practices and dermatology clinics. ACD was the cause of 9.2 million visits to American dermatologists in 2004, representing the third most common reason for outpatient dermatology visits ("Most prevalent skin diseases," 2005). Additionally, the caregivers in these same occupational settings, for example nurses, physician assistants, and physicians, also share a high incidence of this disease. In 2004, approximately 72 million Americans were estimated to have or had contact dermatitis allergic and irritant contact dermatitis ("Most prevalent skin diseases," 2005). In 1999, the National Research Council-Occupational Exposure

Survey discerned that the cost to society of professionally treated ACD including lost work days was \$1 billion annually, and this number did not include over-the-counter medications (National Occupation Research Agenda, 1999). In 2004, \$1.35 billion was spent on medications and physician visits for contact dermatitis ("Most prevalent skin diseases," 2005). Even more profound about the cost of this devastating disease is that it is curable, given appropriate skilled testing, evaluation, and education.

The spectrum of contact dermatitis ranges from irritant contact dermatitis and contact urticaria to allergic contact dermatitis. Approximately 80% of the exogenous dermatides are accounted for by irritant contact dermatitis, as opposed to endogenous, such as psoriasis and atopic dermatitis. Irritant contact dermatitis represents a nonspecific response to chemical or mechanical injury corresponding to a dysfunction in the skin barrier. Detergents, water, wet work, and frequent hand washing predispose to irritant reactions because they damage the epidermal barrier. Contact urticaria (hives) represents IgE-mediated immediate type hypersensitivity. Characteristically contact urticaria presents as wheals and flares and can include severe respiratory compromise, anaphylaxis, and death. The foremost example of this would be latex hypersensitivity (Sussman & Beezhold, 1995; Wakelin & White, 1999; Yunginger, 2003). The primary focus of this article is the mechanisms and modality of allergic contact dermatitis, highlights of the most common allergens in the United States, and the use of the Thin-layer Rapid Use Epicutaneous (TRUE) test as a screening tool in private practice.

Allergic Contact Dermatitis Mechanism of Action

Allergic contact dermatitis represents a delayed-type hypersensitivity reaction (Type IV hypersensitivity). There are four types of hypersensitivity reactions, which include Type I, immediate-type-IgE-mediated reactions; Type II, antibody-mediated reactions; Type III, immune complex deposition reactions; and Type IV, T-cell-mediated delayed-type reactions.

In type IV reactions, the primary step is sensitization. This is the result of absorption of an allergen chem-

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ical into the skin which elicits an immune response that is remembered on subsequent allergen exposures. These allergens are low-molecular-weight substances that easily penetrate the stratum corneum and covalently bind to keratinocytes in the stratum spinosum below (Yunginger, 2003). This alteration on the surface of the keratinocyte allows for recognition by the antigen-presenting cells of the epidermis – Langerhans cells (Hogan, 2005). These small chemicals bound to the Langerhans cells are taken to the lymph nodes and presented to naïve CD4 T cells. A complex reaction occurs on allergen presentation and cytokines are released which promote proliferation of a clonal population of memory T cells. The memory cells with their new antigen-specific receptors return to the site of exposure and recruit more inflammatory mediators.

Within the first 24 hours after re-exposure to an allergen, the Langerhans cells present the allergen to the T cells. Within 48 hours after re-exposure, there is an overt inflammatory reaction to the allergen (Mydlarski, Katz, Mamelak, & Sauder, 2003). This dermatitis can persist for 3 to 4 weeks even after the antigen is removed (Habif, 2004). The duration and intensity of the allergic reaction depends on the patient's sensitivity to the allergen and the concentration of the allergen absorbed (Habif, 2004). Urushiol is the allergen in the sap of poison ivy, poison oak, and other plants in the *Anacardiaceae* family. It is such a strong sensitizer that it can produce intense inflammation in weak concentrations and can cause sensitization in 10 to 14 days after only one exposure (Habif, 2004). Although a strong allergen, there are several other reasons that poison ivy might be thought to cause immediate reactions. First, exposure can happen at any point in life, and not all patients will remember initial exposure. This first exposure could have simply been brushing by a plant in childhood. Second, urushiol is within the sap which is extremely adherent to skin. In fact after 30 minutes, only 10% of the allergen can be washed off at all (Habif, 2004). This causes the patient to absorb a high concentration of the allergen which is one of the determining factors for intensity of a reaction. Another phenomenon that occurs in allergic contact dermatitis is cross sensitization. This is a process that occurs when a patient already sensitized to one allergen becomes sensitized to a second with similar structure. This can occur through transepidermal absorption, inhalation, or ingestion of allergens (Habif, 2004). Important cross sensitizers to poison ivy are poison oak and sumac, Florida Holly, mango rind, and cashew nut resin (Habif, 2004).

Allergen Sources

Allergens are commonly found in routine daily hygiene products such as vitamins (chromium, B12) and medicaments (Neosporin®, topical corticosteroid creams). The most common allergens in the United States are listed in Table 1. For this review, the major allergens have been grouped into classification categories of metals and antimicrobials.

Metals

Metal allergy can present in the form of vesicles, eczematoid plaques, or lichenified plaques. Classically it is seen in the distribution of the contact with the metal product itself, such as a jeans snap or school chair. However, once sensitization has occurred, challenge and the ensuing inflammatory response can be triggered by a myriad of minor contactant exposures from food sources to multivitamins and metallic objects. As contact dermatitis is a dose-dependent phenomenon, each exposure adds to the cumulative dose (Friedmann, 1990).

Nickel is the number one allergy internationally (Saripalli, Achen, & Belsito, 2003). Nickel is found in a wide variety of places from jean snaps to costume jewelry, surgical instruments, medical chart clips, and coins. Nickel is also high in certain foods such as chocolate, soy, and asparagus (Flyvholm, Nielsen, & Andersen, 1984). The second most common metal allergy of special note is *gold* (Marks, Belsito, & DeLeo, 2003). A dermatitis to this metal is becoming more common as cultural practices change, such as piercing infants' ears. Gold leaf is added to some baked goods, as well as Goldschlager liquor.

Cobalt is the third highest instigator of metal allergy (Marks et al., 2003). It is found in dental amalgams and bridges, porcelains, and glass, as well as metal buckles, zippers, and utensils (Gawkrodger, 2005). Additionally it is found in foods such as B12 vitamin, apricots, chocolate, and liver (Garner, 2004). *Chromate* is another frequent cause of metal dermatitis, and is found in cement, plaster, drywall, yellow and green pigments (in paint and tattoos), and multivitamins (Rietschel & Fowler, 1995). Several foods high in chromium are brewer's yeast, liver, black pepper, molasses, eggs, banana, and spinach) (Weiler & Russel, 1986).

Antimicrobial Preservatives and Antimicrobials

There is a consumer tendency to seek out a product's *active* ingredients when purchasing a new product, while deeming the *inactive* ingredients to be superfluous information. Often, these inactive ingredients contain known sensitizing antimicrobial preservatives. The preservatives are ubiquitous in medical creams and ointments, lotions, make-up, and shampoos, for example, as they are added to extend the shelf-life of these products. Companies are permitted to change the ingredients of their products, without completely redesigning the label. While the ingredient list may change, many persons do not realize that a similar label could contain alternate ingredients. This necessitates careful instruction on label reading. Although many product labels do not list inactive ingredients, companies are still under disclosure mandates. One exception to this is products not regulated by the U.S. Food and Drug Administration (FDA), such as herbal remedies. Allergies to these can be seen in patients with chronic skin diseases, who subsequently use these medications or in more sensitive infrequent users. Two of the most common antimicrobial allergens are notoriously seen in several over-the-counter prod-

Table 1.
Allergen Reference Table

Allergen	Products Allergen Found in	Foods/Drugs Allergen Found in
Nickel sulfate	Jean snaps, metal pens, paper clips, cigarettes	Chocolate, soy, beer, oatmeal
Bacitracin	Neosporin, polysporin, polymyxin, bacitracin zinc	Animal feed
Neomycin sulfate	Neosporin, polysporin, neomycin	N/A
Fragrance mix	Cosmetics, detergents, soaps, deodorant	May cross react with tomato, cinnamon, vanilla
Quaternium 15	Formaldehyde-releasing preservative (FRP), baby lotion, baby wipes, cross reacts with permanent press clothing (PPC), and other FRPs	See formaldehyde
Formaldehyde	Paper products, nail polish, mascara lotion, shampoo, permanent press clothing	Jellies, preserved fruits, instant coffee, frozen cod, pollock and haddock, Italian cheeses, smoked ham skin, maple syrup, herring, caviar, diet cola, aspartame
Thimerosal	Preservative in vaccines, antifungal agents, mascara	N/A
Balsam of Peru	Flavoring agents, wound healing agent, baby care products, hemorrhoid preparations, toothpaste	Cross reacts with tomato, cinnamon, vanilla, chocolate, and cola
Cobalt chloride	Metals: buckles, snaps, dental amalgam	Vitamin B ₁₂ , cocoa, liver, apricots
Sodium gold thiosulfate	Jewelry	Goldschlager liqueur
Thiuram mix	Rubber accelerator: rubber gloves, syringe stoppers, toothbrushes, basketballs, shampoos	Cross reacts with antabuse and flea powder
P-phenylenediamine	Hair dye, henna, neoprene	Can cross react with black rubber mix, sulfonamides Sulphonylureas, hydrochlorothiazide
Ethylene urea/melamine	Formaldehyde resin for textiles: permanent press, corduroy, rayon. Breakdown product of mancozeb, a fungicide, and zineb, a pesticide.	Widely used on fruit and vegetable crops.
MDBG/PE (Euxyl K)	Preservative: Nivea®, moist towelettes	N/A
Methylchloroisothiazolinone/ Methylisothiazolinone	Preservative: Eucerin®, latex paints, cleaning products, adhesives, topical medications	N/A
Bronopol	FRP, cross reacts with PPC	N/A
Carba mix	Rubber accelerator: rubber bands, gloves, waistbands, basketballs	Cross react with disulfiram
Diazolidinyl urea	FRP, cross reacts with other FRP and PPC	N/A
Potassium dichromate	Metals, concrete, plaster, green pigment	Brewer's yeast, liver, bananas
DMDM Hydantoin	FRP, cross reacts with other FRP and PPC	N/A

Sources: Bohn et al., 2000; DermNet.com, 2005a; DermNet.com, 2005b; DermNet.com, 2005c; FDA, 2005; Flyvholm et al., 1984; Fuchs & Wahl, 1992; Garner, 2004; Gawkrödger, 2005; Geier et al., 2003; Gette et al., 1992; Hayashi et al., 1986; Hill & Belsito, 2003; Hogan, 2005; IPCS, 2005; Jacob & James, 2004; Menne et al., 1992; Onder et al., 2001; Rietschel & Fowler, 1995; Salam & Fowler, 2003; Saripalli et al., 2003; Schaller et al., 1989; Weiler & Russel, 1986; TRUEtest.com, 2001a, b, c

ucts, namely first aid kits. A common misconception is that *over-the-counter* is synonymous with *benign or inert*, but with each medication there is an inherent risk and benefit ratio that should be evaluated since many contain potential allergens.

Neomycin is a topical antibiotic found in the ointments used daily for minor cuts and abrasions (Neosporin, poly-

sporin) and in medicated eye and ear drops. In fact, people who have had frequent otitis externa are more likely to have a sensitivity reaction to neomycin (Van Ginkel, Bruintjes, & Huizing, 1995). These patients can then develop systemic dermatitis if treated with an aminoglycoside antibiotic, such as gentamicin, which stimulates the immune system through cross reactivity.

Bacitracin, an antibiotic, is added to medications and eye drops similarly to neomycin. Actually, it is often combined with neomycin and other antibiotics in first aid products. Due to the increasing exposure to this antibiotic ointment, bacitracin has landed near the top of the list for common allergens in the United States. There have been reports that 2% of patients who use bacitracin postoperatively have a reaction but, more importantly, there have also been several reports of anaphylaxis (Gette, Marks, & Maloney, 1992; Jacob & James, 2004).

Thimerosal, an organic mercurial compound, is used as a preservative in vaccinations (tetanus) and cosmetics. Like many other preservatives, it is found in a wide variety of otic and ophthalmic solutions, including contact lens solutions and cleansers. Patients with thimerosal allergies can have an acute hypersensitivity reaction to vaccinations. The Public Health Agency in Canada has recommended that these patients receive their vaccinations in an environment with resuscitation capabilities (Canada Communicable Disease Report, 2003). Additionally, the FDA has put forth the discontinuation or minimalization of use in U.S. vaccines (FDA, 2005).

Methylchloroisothiazolinone/Methylisothiazolinone (MCI/MI) is a preservative that is commonly used in cosmetics, shampoo, and bubble bath, but also has a utility as a pesticide. The last decade has seen a replacement of solvent-based paints with more ecologically friendly paints such as water-based paints. These new paints need more preservatives than their predecessors, and MCI has quickly taken its place as the most common preservative in water-based paints (Reinhard et al., 2001). This has led to more and more patients presenting with an airborne contact dermatitis from the MCI in the paint. These patients present with a rash on their air-exposed skin and respiratory symptoms (Bohn, Niederer, Brehm, & Bircher, 2000).

Parabens are some of the most widely used preservatives found in consumables (mayonnaise, frozen dairy products, jellies) to leave-on products (eye shadow, sunscreen, lotions). Parabens are found in rectal and vaginal creams, as well as injectable and topical anesthetics. Notably, while parabens are the most prevalent preservative in all topical therapeutic preparations, they are the least sensitizing overall. In the allergic individual however, the allergic response can be smoldering, dramatic, and systemic (DermNet.com, 2005a). This underscores the importance for patients with an allergy to inform all of their health care providers to assure avoidance.

An allergy to *formaldehyde-releasing preservatives* and *formaldehyde* is very common due to its widespread use. Of course, this goes hand-in-hand with the difficulty of avoidance. For example, cigarettes are preserved with a formaldehyde resin, so patients are at risk for exposure by smoking or second-hand smoke (Schaller, Triebig, & Beyer, 1989). The current guideline is for formaldehyde content to be less than 0.2% for leave-on products; however, 5% is permissible in nail polish as a hardener (International Programme on Chemical Safety, 2002).

Cosmetics, home cleaners, baby wipes, deodorants, and shampoos are important sources for exposure. Wrinkle-free clothing is treated with a formaldehyde textile resin, and dry cleaning is a process using formaldehyde (Rietschel & Fowler, 1995). Patients with allergies to formaldehyde commonly present with *trouser dermatitis*, which is a dermatitis between the thighs or behind the knees due to friction between clothes and skin (DermNet.com, 2005b).

Rubber Chemical

Allergies to rubber chemicals can be caused by the raw rubber compound (latex) or the chemicals added to improve its utility. Allergy to the natural latex component is well documented as a type I (IgE) mediated response (Sussman & Beezhold, 1995). Alternatively the processing chemicals of the rubber, accelerators (carbamates, mercaptobenzothiazoles, and thiurams), and vulcanizers are known to cause the typical type IV delayed hypersensitivity reaction. Accelerators help harden and shape the latex collected from the *Hevea brasiliensis* tree (Mydlarski et al., 2003). Many patients will suspect a latex allergy when they experience a reaction to rubber gloves. Latex allergy testing can be performed with an allergy-specific IgE antibody test or by dermal prick testing, while testing for rubber processing chemical allergies is done by the patch test. Allergies to the rubber processing chemicals are very common among health care workers and atopic patients (Fuchs & Wahl, 1992).

Carbamates are found within the rubber components of toys, elastics, and gloves. This can present with a distinctive dermatitis in the distribution of underwear elastic and the dorsal aspect of the hands in a common locale. *Mercaptobenzothiazole* is one of the most common causes of shoe rubber allergies. Mercaptobenzothiazole commonly causes what is known as *scuba diver dermatitis*, a reaction to diving masks (Freiman, Barankin, & Elpern, 2004). These patients will present with erythema and pruritus surrounding their eyes. *Thiuram*, another accelerator, is the most common cause of glove allergy; however, it is also used as an antimicrobial. It can be found in fungicides and soaps (Geier, Lessmann, Uter, & Schnuch, 2003). Contraceptives including diaphragms, dental dams, and condoms may contain thiuram (DermNet.com, 2005c). Patients can react to condoms due to a latex allergy or sensitization to a rubber accelerator (Bircher, Hirsbrunner, & Langauer, 1993). There is even a case report of sensitization to thiuram from the sticky backing of a temporary tattoo (Hallai, Meirion-Hughes, & Stone, 2004).

Black rubber mix is a rubber additive used in industrial rubber products such as for belts and tubing; however, it can be found in sports equipment (TRUEtest.com, 2001a). Black rubber mix cross reacts with PPD (hair dye), so patients should avoid both allergens (Menne, White, Bruynzeel, & Dooms-Goossens, 1992). PPD is widely used in hair dye, even though the FDA prohibits its use on skin. This has not stopped companies from adding it to temporary henna tattoos to

make them last longer; several case reports describe children reacting to henna tattoos (Onder, Atahan, Oztas, & Oztas, 2001). Hairstylists are at high risk for developing an allergy, but exposure may put them at risk for much worse conditions (Sosted, Rastogi, Andersen, Johansen, & Menne, 2004). Studies show an association with bladder cancer and PPD in rats (Nohynek et al., 2004). There are also notable racial differences in incidence rates. In one study, black patients had a higher incidence of sensitization to PPD than white patients. The number of people coloring their hair seems to be the same across racial and ethnic groups, but the amount of PPD in darker hair dyes is increased (Deleo et al., 2002). The patients will present with a characteristic dermatitis around their eyes, ears, and adjoining face, but sparing the scalp. PPD was recently nominated for allergen of the year because of dramatic rise in incidence.

Glues

Glues and adhesives are other common allergens due to their widespread use as bonding agents, both in the home environment in personal products and in the occupational environment. The thought of adhesive use in arts and crafts seems par for the course, but glues are used to compound rubber to plastics and leathers in items such as in hair brushes, toothbrushes, sports balls, and sneakers.

Colophony is a tree sap resin whose inherent utility lies in its stickiness. It is commonly used as an adhesive for plaster products and flooring, and also to enable long-wearing cosmetics. Colophony is the substance that keeps the mascara and lipstick on the eyelashes and lips. Even adhesive bandages “stick” because of colophony (Karlberga, 1988). Colophony or rosin, as it is known to musicians of stringed instruments, is used to help the strings stick to the bow. Due to the prolonged contact of the instrumentalist and his or her instrument, professional musicians are actually at increased risk for an allergy to the rosin they use daily (Gambichler, Boms, & Freitag, 2004). Reactions to colophony often cause intense pruritus with a dermatitis usually limited to the area of direct contact. Cross reactions are possible with balsam of Peru and other “natural” resins.

Epoxy is a synthetic glue used in many plastic products. Due to the high heat resistance, epoxies are used for high-strength bonds in airplanes, automobiles, bikes, and boats (Wikipedia, 2005). Metal cans and containers are often coated with epoxy to retard rusting from acidic foods such as tomatoes (Howe, Borodinsky, & Lyon, 1998; Wikipedia, 2005). It is a common encasing for electrical wiring to protect cables from dust and humidity (Wikipedia, 2005). Epoxies are also used in eyeglass frames and hearing aides. Computer technicians and plastic workers are at higher risk for an allergy (Tarvainen, Kanerva, Jolanki, & Estlander, 1995). Artists, due to their high exposure to paints and lacquers, are also at high risk (Haz-Map, 2004).

Methylmethacrylate is a common constituent of dental

fillings and dentures. Acrylates are also used in artificial joints and heart valves. Dentists, dental technicians, and orthopedic surgeons are all more likely to have an allergy to acrylates. There have even been acrylate allergies to acrylic nails and incontinency pads (Giroux & Pratt, 2002). Importantly, nitrile rubber gloves should be used in these allergic workers to prevent further exposure and sensitization.

Fragrances

Fragrance perfumes and flavoring agents are found in foods, soaps, shaving cream, shampoos, and even unscented products. Unscented products may contain a masking fragrance, which blocks unwanted scents. *Fragrance free*, on the other hand, refers to the absence of ingredients added to enhance or eliminate a scent. Currently, there are thousands of available fragrances for industrial use from perfumes to sanitation (Hogan, 2005). Individuals with fragrance allergies might only have an allergy to one specific fragrance, but unfortunately the companies do not have to list what specific fragrance is in their product, they can just list “fragrance.” Fragrances commonly present as a reaction to deodorant (Johansen et al., 1998). Massage therapists, geriatric nurses, and glass makers are at a higher risk for exposure to fragrances (Uter, Schnuch, Geier, Pfahllberg, & Gefeller, 2001).

Balsam of Peru is a composite tree sap resin used as a fragrance, a flavoring, and a therapeutic agent. Although the product is only a weak antibiotic, many companies have found reasons to add it to hemorrhoid creams and other topical medications. Balsam of Peru is almost ubiquitous in our man-made environment. It is found in tobacco, perfume, chocolate, cola, spices, vermouth, and even some dentistry cements. Beyond where it is actually found, Balsam of Peru can cross react with numerous food products such as tomato products, including pizza sauce and ketchup (Salam & Fowler, 2003).

Allergen Evaluation

Dermatology and allergy specialists use patch testing to diagnose patients with allergic contact dermatitis. Patch testing is the gold standard for patients with ACD. The most commonly used patch test is the Thin-layer Rapid Use Epicutaneous (TRUE) Test[®] which is a prepackaged commercially available allergen patch test consisting of 23 common allergens and one negative control. The North American Standard Series formulated by the North American Contact Dermatitis Group consists of a regularly updated series of 65 of the most common allergens and is utilized by contact dermatitis specialists.

The TRUE test, while limited to 23 allergens, is widely available. It can be used as a basic screening tool to ascertain some of the more common allergies in patients in areas where access to a contact dermatitis specialist is limited or unavailable. Over 3,700 antigens exist that can cause reactions in people and the TRUE test only recognizes 23 of these. Research and compari-

Table 2.
Reasons for False-Positive and False-Negative Readings

False Positives	False Negatives
Acute dermatitis during patch test	Degraded or expired testing materials
Degraded or expired testing materials	Early reading
Irritable or sensitive skin	Lack of UV light for photosensitizing allergens
Recent patch testing at same site	Narrow the scope of clinical investigation
Reaction to tape or aluminum/plastic wells	Showering or sweating during the test
Strong reaction to neighboring allergen	Sun exposure prior to the test
Inexperienced evaluator	Corticosteroids prior to the test

Sources: Bourke et al., 2001; TRUEtest.com, 2001b

son with the North American Contact Dermatitis Series suggests that the TRUE test is missing clinically important and common allergens (Krob, Fleischer, D'Agostino, Haverstock, & Feldman, 2004). In one study, the TRUE test only succeeded in identifying an allergen in 24.5% of patients with ACD (Saripalli et al., 2003). Furthermore, the test partially evaluated 52% of patients with ACD by not identifying all of their relevant allergens (Saripalli et al., 2003). Patients with more complicated cases or refractory dermatitis following avoidance regimens may need referral to a contact dermatitis clinic.

Patch tests are a multiple-step process. First, the provider must elicit a pertinent and relevant history from the patient in order to determine which of the 3,700 allergens to test. Since the test is cumbersome for the patient in requiring abstinence from washing the test site for the duration of the test and being taped for the initial 48 hours of the test, proper performance of the patch test is imperative. On the first day, the patch is placed on the patient's back. It is important to place the patch in an area where there is no dermatitis, ultraviolet exposure, or topical corticosteroid use (Rakel & Bope, 2005). If the patient already is dermatitic in the area of the patch test, it will be difficult to determine which reaction is due to the patch. Sun damage can blunt the ability of the Langerhans cells to identify an allergen, leading to a false-negative test in the presence of an allergy (Murphy, Sellheyer, & Mihm, 2005). After 48 hours, the patch is professionally removed and a preliminary evaluation is done. At this 48-hour read, severe reactions and irritant reactions can be seen. The final evaluation and interpretation of the test are done between 96 and 120 hours.

At the final reading, all positive reactions must be interpreted by a skilled evaluator to distinguish between, for example, an allergic or irritant response and the clinical relevance of the allergen (Cohen, Brancaccio, Andersen, & Belsito, 1997). Reading and interpretation goes beyond *negative* and *positive*. There are several reactions patients can have to an allergen. The allergens are formulated to exact concentrations in order to elicit an

allergic reaction in patients who are sensitized, without inducing overwhelming irritation. Additionally, irritant-based contact dermatitis can be induced by any practice that strips the outer protective layer of the skin. Surgeons, with frequent scrubbing of their hands with strong soaps, commonly develop irritant contact dermatitis (Antezana & Parker, 2003). Patients with a history of atopic dermatitis are also at increased risk for this, as well as nonspecific hand dermatitis (Antezana & Parker, 2003).

Irritant reactions will often fade over the subsequent days following patch removal, whereas allergic reactions can worsen over the course of the testing period (Antezana & Parker, 2003). This further underscores the importance of a delayed final reading after 96 hours. This read can be useful in distinguishing between irritants and true allergens. False positives can also occur due to an extremely positive reaction "overflowing" in its neighbor's space or leaking of an antigen into another area, also known as *angry back syndrome*. False negatives can occur for many reasons including inadequate contact of the patch chemical on the patient's back. Reading a patch too soon, before a patient has reacted, results in a false-negative read. Other allergens such as gold or bacitracin take on average 7 to 14 days to cause a reaction (Rakel & Bope, 2005). The health care provider must warn patients about these delayed reactions in order not to miss a reaction. See Table 2 for reasons for false positives and false negatives.

A critical component of the patch test is patient education. It is imperative that the patient fully understands the test and complies with the procedure and resultant avoidance regimen. Providing the patient with information on specific allergens, synonymous names, and cross reactors in addition to suggestions on how to avoid the allergens is the final step of patch testing. A patient who knows what he/she is allergic to but does not know how to avoid it, is no better able to comply than a patient who has not been patch tested. The American Contact Dermatitis Society has generated a Contact Allergen Replacement Database. This database is a cross-referencing tool which accesses ingredients of products. The

allergens are inputted into the database and a personalized product list free of the patients' allergens is generated to help guide the patient towards safe alternatives.

In summary, ACD is an important disease with high impact in terms of patients' well-being and medical economics. The art of patch testing starts with eliciting a pertinent history of exposures from the patient, compiling the allergen list to test, properly performing the patch procedure, and educating the patient on avoidance at the conclusion of the test. This important modality can be used to identify and avoid the culprit allergen and cure the patient of dermatitis. The purpose of this article is to highlight common allergens encountered in our environment on a daily basis and to increase awareness for this important disease. An early index of suspicion can lead to appropriate testing, diagnosis, avoidance, and cure. ■

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continued on page 446

4. *Pernio (chilblain)* is the correct answer. Pernio is an uncommon disease that usually occurs in Winter months. It occurs when there is an abnormal reaction to cold. Dover, Dowd, and Tonnesen (1996) describe it as a persistent cold-induced constriction of the large cutaneous arterioles and a persistent dilatation of the smaller, more superficial vessels.

Nursing Measures

This disease is exacerbated by cold. Thus, the patient should be instructed to protect her fingers from cold at all times in the cold months and wear gloves at all times when outside. She should even wear gloves at home if it is unseasonably cold and difficult to warm her home. The problem resolves as the weather warms but may occur again next season so she should take extra precautions. Chilblain can also involve the feet and attention should be given to keeping her feet dry and warm in the Winter months. If not treated, superficial gangrene can result.

Teaching Point

The mainstay of treatment is with nifedipine XL 30 mg daily. This drug is a calcium channel blocker indicated in the treatment of vasospastic and chronic angina. This patient was referred from urgent care but does in fact have a primary care provider. The primary care provider should be notified of this patient's diagnosis and the need for prescribing the medication. Should the primary care provider agree with this plan, the dermatologist can write the prescription for the drug. However, the primary care physician should see this patient within a few weeks to evaluate how she is responding to and tolerating the calcium channel blocker. Should the patient not have a primary care provider, the dermatologist can prescribe the drug and instruct the patient to be followed by a primary care provider as soon as possible. ♦

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Allergic Contact Dermatitis

continued from page 439

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