Title: Systemic Contact Dermatitis and Low Allergen Diets

Authors: Emma Weiss, Rajani Katta MD

This is a non-final version of an article published in final form in:

Weiss E, Katta R. Systemic contact dermatitis and low allergen diets. Journal of Dermatology Nurses' Association 2017;9:28-30

Link to final published article

Abstract

Systemic contact dermatitis (SCD) is a skin reaction that occurs after systemic exposure to a previously encountered allergen. This exposure may occur through oral, intravenous, percutaneous or inhalational routes. Symptoms usually manifest less than 24 hours after exposure (Fabbro & Zirwas, 2014). One clue to diagnosis is the occurrence of non-resolving, recurrent episodes of contact dermatitis despite avoiding known allergens. Another clue is a reaction at the positive patch test site after ingestion of the suspected allergen (Lowther, McCormick, & Nedorost, 2008). Treatment of SCD involves avoiding all systemic exposure to an allergen. This includes removal of the allergen from the diet. This paper will focus on four major food allergens that cause SCD and describe relevant dietary sources in order to serve as a guide for patient education.

Nickel

Ingested nickel is the most common source of SCD. In a patient with prior history of allergic contact dermatitis (ACD), the classic presentation of nickel SCD is a relapsing vesicular rash on both hands following ingestion of nickel-rich foods. Less common manifestations are reports of pruritic papules on the elbow and generalized dermatitis.

Several studies have demonstrated that adherence to a low nickel diet can alleviate the relapsing vesicular rash associated with nickel SCD. Veien's (1993) prospective trial found that 73% of patients reported disappearance of their skin eruptions after following a low nickel diet for 4 weeks. Jensen et al's (2003) double blind, placebo-controlled trial demonstrated that patients who are sensitive to nickel showed more cutaneous reactions following ingestion of higher nickel doses, thus supporting the rationale of a low nickel diet. Responses to a low nickel diet differ due to variations in diet adherence and in

severity of SCD manifestations(Veien et al., 1993).

Since nickel is pervasive in the average diet and consumption can vary significantly according to regional water and soil content, careful counseling of patients with nickel allergies is imperative to reduce symptoms. The most effective therapeutic recommendation is to avoid ingesting high nickel foods, such as those listed in **Table 1**. Even with proper adherence to a low-nickel diet, a small amount of nickel in the daily diet is unavoidable. Therefore, other treatments may be required. Oral disulfiram acts to chelate nickel, and may be used to help decrease symptoms (Fowler, 1992).

Balsam of Peru

Balsam of Peru (BOP) is an aromatic plant extract that is used as a fragrance additive and a flavoring agent. It is used in many cosmetic and food products due to its vanilla and cinnamon components (HJORTH, 1961). Its components are also found in certain foods, including tomatoes, citrus, and spices. BOP serves as a common flavoring ingredient in many household items such as toothpaste, lip balm, and mouthwash to provide a minty, fresh taste. The use of topical cosmetics containing fragrance additives may sensitize patients. This may then predispose them to SCD with subsequent oral ingestion (Bedello, Goitre, & Cane, 1982)**.**

The typical presentation of BOP SCD is that of a vesicular dermatitis on the face, hands, and anogenitial region (Salam & Fowler, 2001). Allergy to BOP is diagnosed by a positive patch test to either BOP or fragrance mix (FM). If the dermatitis persists after avoidance of products with fragrance and BOP-related compounds, then a BOP-restricted diet can be implemented. A list of Balsam-related foods and products to avoid are provided in **Table 2.**

Adherence to a BOP-restricted diet has been shown to help decrease symptoms associated with SCD. The goal of a BOP-restricted diet is to identify specific foods that trigger SCD, so that the patients may reintroduce non-immunogenic foods in order to maintain a healthy and diverse diet. It may take 6-8 weeks of dietary adherence to note improvement in symptoms. In a study by Salam and Fowler (2001), half of the participants with a positive patch test to BOP showed significant improvement in their dermatitis when following a BOP-restricted diet. In addition, Veien et al (1983) demonstrated complete relief of eczema symptoms in 55% of balsam-sensitive patients when following a balsam-restricted diet.

Propylene Glycol

Propylene glycol (PG) is an organic compound commonly found in cosmetic products, topical skin medications, and food. It is often used because of its properties as a solvent, humectant, and preservative. Propylene glycol has been demonstrated to cause SCD after ingestion in previously sensitized individuals. Diagnosis can be particularly challenging for two reasons. First, positive patch test results are often weak. Second, because propylene glycol may be a skin irritant at high concentrations, patch testing can lead to a false positive result.

Propylene glycol is used in food as a thickening agent and a preservative, and it protects food from freezing. Common dietary sources of propylene glycol include boxed cake mixes, salad dressings, and sour cream (Warshaw et al., 2008). It can also be found in other items including toothpaste, mouthwash, lip balm, and breath freshener. As PG is an additive to processed foods, it will be listed on the ingredient label. **Table 3** lists everyday foods containing propylene glycol.

Eruptions tend to occur at previous sites of contact dermatitis, frequently on the hands, face, neck, and legs. If patients with allergy to PG do not improve following topical avoidance, then a trial of PG dietary avoidance is appropriate. Lowther et al (2008) retrospectively analyzed 652 patients and found that 3% of total subjects had an allergy to propylene glycol. They discovered that a small percentage of patients with a true allergy to propylene glycol had initial patch tests that were misinterpreted as irritants. Thus, it is important to consider weak patch reactions for a trial of topical avoidance and propylene glycol-restricted diet.

Formaldehyde

Formaldehyde is a naturally occurring chemical that can produce toxic and carcinogenic effects at high doses. Common sources include inhalation of indoor air, outdoor air, and cigarette smoke. Formaldehyde may also be ingested via dietary sources. Patients initially become sensitized to formaldehyde mainly through the use of personal care products that contain formaldehyde-releasing preservatives (FRPs) and via exposure to formaldehyde-containing resins found in fabric and clothing. SCD may result from both inhalation and dietary sources. Inhalation sources include formaldehyde-containing gasses that arise from insulation and flooring within buildings, as well as smoke and pollution (Tang et al., 2009). SCD in formaldehyde-sensitized individuals also occurs through ingestion of ingredients that are metabolized into formaldehyde within the body. In particular, the artificial sweetener aspartame is converted to methanol and subsequently metabolized into formic acid. This has been reported to cause SCD in previously sensitized individuals (Hill & Belsito, 2003).

Hill and Belsito (2003) first documented disappearance of eyelid dermatitis after

discontinuation of aspartame-containing food and drinks. Herro et al's (2012) retrospective study found formaldehyde as the most common source of ACD of the eyelids. Notably, the majority of patients were women who consumed diet soda with aspartame in addition to using products that contained formaldehyde or FRPs. Upon avoidance of both topical and systemic sources of formaldehyde, 90% of patients reached full remission. Of the small percentage of patients willing to reintroduce aspartame into their diet, 100% of participants experienced flares of eyelid dermatitis (Herro et al., 2012).

Eyelid dermatitis is the most common presentation of formaldehyde SCD. Other manifestations include periorbital edema and face, neck, and leg dermatitis. If a patient is patch positive for formaldehyde and topical avoidance has not helped, then it is important to ask about food and drink intake in order to uncover hidden sources of aspartame that could be contributing to their dermatitis. Iatrogenic sources of aspartame should also be considered, especially in pediatric populations, as it is a common additive in chewable and liquid medications.(Castanedo-Tardan, GonzÃ¡lez, Connelly, Giordano, & Jacob, 2009)

References

Bedello, P. G., Goitre, M., & Cane, D. (1982). Contact dermatitis and flare from food flavouring agents. *Contact Dermatitis*, *8*(2), 143–4. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/7067452

Castanedo-Tardan, M. P., GonzÃ¡lez, M. E., Connelly, E. a., Giordano, K., & Jacob, S. E. (2009). Systematized Contact Dermatitis and Montelukast in an Atopic Boy. *Pediatric Dermatology*, *26*(6), 739–743. http://doi.org/10.1111/j.1525-1470.2008.00855.x

Fabbro, S. K., & Zirwas, M. J. (2014). Systemic Contact Dermatitis to Foods: Nickel, BOP, and More. *Current Allergy and Asthma Reports*, *14*(10), 463. http://doi.org/10.1007/s11882-014-0463-3

Fowler, J. F. (1992). Disulfiram is effective for nickel allergy hand eczema. *American Journal of Contact Dermatitis*, *3*(0), 175. http://doi.org/10.1111/j.1600-0536.2012.02153.x

Herro, E. M., Elsaie, M. L., Nijhawan, R. I., & Jacob, S. E. (2012). Recommendations for a Screening Series for Allergic Contact Eyelid Dermatitis. *Dermatitis*, *23*(1), 17–21. http://doi.org/10.1097/DER.0b013e31823d191f

Hill, M., & Belsito, D. V. (2003). Systemic contact dermatitis of the eyelids caused by formaldehyde derived from aspartame? *Contact Dermatitis*, *49*(5), 258–272. http://doi.org/10.1057/pt.2009.25

HJORTH, N. (1961). Eczematous allergy to balsams, allied perfumes and flavouring agents, with special reference to balsam of Peru. *Acta Dermato-Venereologica. Supplementum*, *41(Suppl 4*, 1–216. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/13714712

Jensen, C. S., Menné, T., Lisby, S., Kristiansen, J., & Veien, N. K. (2003). Experimental systemic contact dermatitis from nickel: A dose-response study. *Contact Dermatitis*, *49*(3), 124–132. http://doi.org/10.1111/j.0105-1873.2003.00157.x

Kaden, D. A., Mandin, C., Nielsen, G. D., & Wolkoff, P. (2010). Formaldehyde. World Health Organization. Retrieved from http://www.ncbi.nlm.nih.gov/books/NBK138711/

Lowther, A., McCormick, T., & Nedorost, S. (2008). Systemic contact dermatitis from propylene glycol. *Dermatitis : Contact, Atopic, Occupational, Drug : Official Journal of the American Contact Dermatitis Society, North American Contact Dermatitis Group*, *19*(2), 105–108. http://doi.org/10.2310/6620.2008.07037

Salam, T. N., & Fowler, J. F. (2001). Balsam-related systemic contact dermatitis. *Journal of the American Academy of Dermatology*, *45*(3), 377–381. http://doi.org/10.1067/mjd.2001.114738

Scheman, A., Jacob, S., Zirwas, M., Warshaw, E., Nedorost, S., Katta, R., … Castanedo-Tardan, M. P. (2008). Contact Allergy: Alternatives for the 2007 North American Contact Dermatitis Group (NACDG) Standard Screening Tray. *Disease-a-Month*, *54*(1-2), 7–156. http://doi.org/10.1016/j.disamonth.2007.10.002

Tang, X., Bai, Y., Duong, A., Smith, M. T., Li, L., & Zhang, L. (2009). Formaldehyde in China: Production, consumption, exposure levels, and health effects. *Environment International*, *35*(8), 1210–1224. http://doi.org/10.1016/j.envint.2009.06.002

Veien, N. K., Hattel, T., & Laurberg, G. (1993). Low nickel diet: an open, prospective trial. *Journal of the American Academy of Dermatology*, *29*(6), 1002–1007. http://doi.org/10.1016/0190-9622(93)70281-W

Veien, N K, Hattel T, Justesen O, N. A. (1983). Oral challenge with balsam of Peru in patients with eczema: a preliminary study. Contact Dermatitis 1983;9:75-6. *Contact Dermatitis*, *9*, 75.

Warshaw, E. M., Botto, N. C., Zug, K. a, Belsito, D. V, Maibach, H. I., Sasseville, D., … Rietschel, R. L. (2008). Contact dermatitis associated with food: retrospective cross-sectional analysis of North American Contact Dermatitis Group data, 2001-2004. *Dermatitis : Contact, Atopic, Occupational, Drug : Official Journal of the American Contact Dermatitis Society, North American Contact Dermatitis Group*, *19*(5), 252–260. http://doi.org/10.2310/6620.2008.08012

Appendix

Table 1. Nickel-containing foods to avoid[1]

Grains	Whole wheat bread, multigrain cereals, wheat germ, whole wheat pasta, oatmeal, buckwheat, seeds
Vegetables	Beans, lentils, peas, soy beans, soy products, bean sprouts, kale, lettuce, spinach, vegetable juices, canned vegetables
Fruits	Dates, figs, pineapples, plums, raspberries, canned fruits
Dairy	Chocolate milk
Meat	Shellfish, processed meats with fillers or coatings, canned meats or fish
Other	Chocolate and cocoa powder

1. Scheman et al., 2008

Table 2. Balsam of Peru containing foods to avoid[1]

Fruits & Vegetables	Tomatoes, citrus fruits and products containing citrus fruits such as juices
Spices	Cinnamon, cloves, vanilla, curry, allspice, anise, and ginger
Sauces	Tomato sauces, ketchup, barbeque sauce, chili, Italian or Mexican foods with red sauces, certain flavored vinegars
Sweets	Ice cream, chocolate, candy, chewing gum, and baked goods containing cinnamon and vanilla
Beverages	Certain perfumed or flavored teas, gin and vermouth, colas
Other	Mentholated tobacco products, certain cough medicines and lozenges

1. Salam & Fowler, 2001

Table 3. Potential sources of propylene glycol-containing foods [1]

Sauces	Steak sauce, horseradish, tartar sauce
Sweets	Cinnamon buns, donuts, cupcakes, ice cream, frosting, snow-cone flavoring
Dessert Kits	Cake mix, brownie mix, cookie mix
Medications	Ibuprofen, acetaminophen, glucosamine/chondroitin sulfate
Other	Potato salads, salad dressing, sour cream, potato snacks

1. Lowther et al., 2008