



## Nickel Allergy

### *What It Is and How It Can Affect Our Patient Care*

#### **ABSTRACT**

Nickel allergy is the second most common form of allergic contact dermatitis skin allergy, second only to poison ivy. There is no cure for a nickel allergy. The best treatment is to avoid contact with all products known to have nickel content. Because nickel is present in a vast amount of items used every day in the gastroenterology endoscopy setting, it is not possible to have a nickel-free environment. Nurses need to be aware of items in their facility, which could affect the nickel-allergic patient in an adverse way. The focus should be to limit patient exposure as much as possible. This article provides an overview of nickel allergy and areas of risk for patients in the gastroenterology endoscopy setting.

I was in the endoscopy preprocedure admission area assisting with the preparation of my first patient of the day. The patient, a middle-aged woman, verified that she had an allergy to nickel. I talked with her about her allergy further because I also have an allergic reaction to nickel in jewelry. She said her reaction was to the nickel in foods. She advised me that chocolate was one of the worst foods for her. This was a new area of information for me. I did not realize this was even something that could be a problem. Because of this discussion with my patient, I decided to find out more about nickel allergies in general, but specifically nickel as related to foods. I also wanted to determine what I should know about nickel allergy in relation to our endoscopy procedures in order to provide better care for this and future patients.

#### **Background**

When doing a Google search on the Web, I found more than 133,000 references to nickel allergies. Included were sites about the allergy and signs and symptoms. Sites offered information on the few treatments that

are available. Jewelry makers shared where to go to find nickel-free products. There were also several healthcare-related sites discussing contact dermatitis related to nickel allergy and issues related to nickel in foods.

#### **Nickel Allergy**

Nickel is a metal, a trace element, found naturally in the environment. It is in the air, water, and soil. It is silvery-white in appearance. Mixed with other metals, nickel is used to produce alloys (Mayo Foundation for Medical Education and Research [MFMER], 2010). The most common alloy is nickel and iron, which produces stainless steel (American Osteopathic College of Dermatology, 2012; MFMER, 2010). Stainless steel contains from 5% to 25% nickel (Dartmouth Toxic Metals Superfund Research Program, 2010). The amount of nickel used is regulated by the sharpness, strength, or smoothness desired for the item to be made. Other alloys, which also may include nickel, are used to make a vast variety of common everyday products such as coins, jewelry, and tools. If it is silver in color, it probably has some nickel.

Nickel allergies are on the rise over recent years. This is mostly related to jewelry having a coating of nickel under the external gold or silver plating, or mixed in with the jewelry metal. There is nickel in gold, silver, and platinum to some degree, but nickel is more likely to be found in the cheaper costume jewelry. According to the literature, 10% (to as high as 15%) of women ("Coping with nickel allergy," 2000–2012)

*Received January 3, 2012; accepted March 11, 2012.*

*About the author: Janet Hannah, RN, CGRN, is Endoscopy Staff Nurse & Educator, Inova Loudoun Ambulatory Surgical Center, Leesburg, Virginia.*

*The author and planners have disclosed that they have no financial relationships related to this article.*

*Correspondence to: Janet Hannah, RN, CGRN, Inova Loudoun Ambulatory Surgical Center, 44045 Riverside Parkway, Leesburg, VA 20176 (e-mail: hannahj54@gmail.com).*

*DOI: 10.1097/SGA.0b013e3182603090*

and as many as 6% of men (MFMER, 2010) are estimated to be allergic to nickel. Women are thought to have a higher percentage of reaction because more women have pierced ears (MFMER, 2010). As more men wear earrings and as people get piercings in other areas of the body, this may change.

There can also be occupational exposures. Hairdressers may have a prevalence of 27% or higher (Sharma, 2007). Retail clerks who deal with coin money daily are at risk to exposure (MFMER, 2010). Men may also have occupational exposures to nickel because of the jobs such as painting or welding they perform (Dartmouth Toxic Metals Superfund Research Program, 2010). Long-term exposure to fumes and dust as found in refining industries can result in pulmonary fibrosis, chronic bronchitis, cancer, and death (Dartmouth Toxic Metals Superfund Research Program, 2010). To limit the exposure, facemasks are required in these environments (Dartmouth Toxic Metals Superfund Research Program, 2010).

The literature also stated that sensitivity to nickel may be partly inherited (MFMER, 2010). German researchers have found that nickel triggers a component of the receptors that act as gatekeepers of immunity—toll-like receptor 4 (Katsnelson, 2010). This generates a signal that stimulates the inflammation and the dermatitis develops (Katsnelson, 2010).

Nickel allergy is the second most common form of allergic contact dermatitis skin allergy. It is second only to poison ivy (WebMD Medical Reference, 2011). Contact dermatitis is when an itchy rash appears when your skin touches a substance that is typically harmless (MFMER, 2010). The area becomes itchy, red, sometimes blistered, sometimes dry, and sometimes patchy looking. Normally associated with jewelry such as earrings or other jewelry connected to body piercings, nickel is also found in many everyday items. Coins, watchbands, dental restorations, and eyeglasses frames have nickel content. Cigarettes and some makeup may contain nickel. Table 1 lists common items that contain nickel.

The allergy may develop after a first exposure or after repeated and/or long-term exposure to items that contain nickel (WebMD Medical Reference, 2011). The allergy usually develops in an adult but can develop at any age. Once you develop a nickel allergy, it will usually be a chronic problem (MFMER, 2010; Sharma, 2007). A person may have worn a ring for years and develops a reaction after piercing the ears and may now not be able to wear the ring.

To confirm whether a person truly has a nickel allergy, a skin patch test can be done (MFMER, 2010; <http://www.NickelAllergyFree.com>). This involves the application of tiny amounts of the suspected allergen directly into the skin, either on the arm or on the back. The areas injected with the allergen are then moni-

tored for signs of reaction. However, patch tests may not give conclusive results (MFMER, 2010). The allergy is not really caused by the nickel itself, but by the nickel salts, which develop after perspiration comes in contact with the piece of jewelry. This causes corrosion of the object. The dermatitis or eczema develops where the nickel or metal containing nickel touches the skin.

Hot weather is worse for reaction incidences because of perspiration buildup (<http://www.NickelAllergyFree.com>; <http://www.achooallergy.com>, 2000–2012). If the skin is already irritated, the reaction will be more severe and occur quicker. The ears, or other areas that are pierced, are affected by the earring. The wrist is affected by a watchstrap or bracelet. The lower abdomen in the waist area could be affected by a buckle or a stud in your jeans (<http://www.NickelAllergyFree.com>). The back may be affected by bra hooks or zippers. Even dental fillings or appliances may contain nickel and cause problems orally. On a personal note, I reacted to surgical steel staples for a closure to the incision from a subtotal thyroidectomy. The staples were removed early and at intervals to prevent the incision from coming apart. The scar is more noticeable because of the reaction to the staples.

### Nickel in Food

But it doesn't stop there. Our food comprises both animals and plants, which have contact with the air, water, and soil. The animals and plants derive their nutrition from these sources; therefore, our food supplies have nickel in them. Since the degree of nickel in the soil varies from region to region, foods have varied amounts of nickel, depending on where and how they are grown including the use of fertilizers and pesticides (Sharma, 2007). It is also noted that seasonal changes can affect the amount of nickel in the soil. It is noted that spring and autumn have increases in nickel concentration, and concentration decreases during midsummer (Sharma, 2007).

Individual intake of nickel ranges, on average, from 69 to 170  $\mu\text{g}$  on a daily basis (MELISA Medica Foundation, 2011). This is comparable with a single grain of sand in mass (Dartmouth Toxic Metals Superfund Research Program, 2010); however, the foods that are eaten can bring that up to 900 mg or more a day (MELISA Medica Foundation, 2011). There is some evidence that the nickel is likely an essential element for humans, but there is no documented condition associated with a deficiency of nickel (Dartmouth Toxic Metals Superfund Research Program, 2010). Therefore, it is believed that the body gets all it needs from its existence in our food and water. It is suggested that 25–35  $\mu\text{g}$  of nickel is sufficient for the normal diet (MELISA Medica Foundation,

**TABLE 1. Items Containing Nickel**

Jewelry	Clothing	Personal Items	Items in the Home	Items at Work
Bracelets	Bra hooks	Artificial heart	Alkaline batteries	Haircut scissors
Earrings	Bra underwires	Cell phone	Bathplug chains	Instruments
Glasses frames	Buttons	Cigarettes	Cabinet handles	Metal shavings from a lathe or chain saw
Necklace clasps	Clips	Compacts	Flashlight	Other tools for home use (hammer, pliers, etc.)
Necklaces	Hair-pins	Dental fillings	Kitchen utensils	Paperclips
Rings	Studs	Herbals	Knives, silverware	Surgery
Watchbands	Suspender	Keys, key rings	Metal teapots	Typewriter keys
	Zippers	Lighters	Needles, pins	
		Lipstick holders	Scissors	
		Makeup, perfumes	Thimble	
		Medications	Toaster	
		Pens	Vacuum cleaners	
		Pocket knives		
		Powder		
		Purse handle		
		Silver coins		
		Valves		
		Vitamins		

2011). Inhaled particles of nickel are removed from the blood by the kidneys and excreted in the urine (Dartmouth Toxic Metals Superfund Research Program, 2010).

Ingested nickel passes through the gastrointestinal (GI) tract where only 1%–10% is absorbed (Sharma, 2007). Many foods contain nickel and can cause problems for those individuals with a nickel allergy. Foods consumed can give rise to episodes of systemic contact dermatitis (involving the whole body with a rash) and worsen the dermatitis on the hands. A single dose of 600–5,600  $\mu\text{g}$  of nickel sulfate given orally has been observed to trigger the hand dermatitis (Flyvholm, Nielson, & Anderson, 1984; Sharma, 2007). As earlier noted, the amount of nickel ingested will vary depending on where the food was grown and the type of soil (Sharma, 2007) and whether the food is fresh or canned. The cooking utensils used to prepare it also affect the nickel content (Dow, 2009). The amount and type of water (bottled or faucet) that is used also make a difference in the nickel in your diet.

A listing of foods with varying degrees of nickel content is provided on the MELISA Web site (<http://www.melisa.org/nickel.php>). Foods routinely high in nickel content are chocolate and cocoa, especially the

darker chocolates; soy beans and products made of soy such as tofu; beans and other legumes; and nuts including walnuts, almonds, peanuts, and hazelnuts (Sharma, 2007). Fish that are high in nickel include salmon, tuna, herring, and shellfish (Sharma, 2007). Drinks high in nickel content include green tea, beer, and red wine (Sharma, 2007). Also, the water from the faucet first time it is run in the morning may have higher nickel content (Sharma, 2007). Canned foods have higher contents of nickel than fresh foods because the foods can absorb nickel from the tin can.

### Treatment Options for Nickel Allergy

There is no cure for a nickel allergy (MFMER, 2010). Several forms of treatment have varying levels of success. The best treatment is to avoid contact with all products you know to have nickel content. This is hard to do. The next best way to deal with these items is to wear gloves when handling them. This would include when using tools, gardening, or doing dishes. Wash hands frequently to avoid buildup of nickel in the residue on your hands. Wear jewelry that is 18- or 24-carat gold, sterling silver, hypoallergenic without nickel, or wear plastic covers over pierced earrings (MFMER, 2010). Putting a clear nail polish over the jewelry item may be of temporary help (MFMER, 2010).

Use leather or cloth watchbands. Wear glasses with plastic frames (Scott, Levender, & Feldman, 2010). For clothing, select items with plastic fasteners, coated metals, or some other type closure that does not involve nickel such as ties or Velcro. Don't load your pants pocket full of coins that can rub through the fabric. Use a coin purse for coins and have the store clerk put the coins in it for you. Use "plastic" to pay for purchases so you won't have any change to deal with. If sitting in a metal chair, put something between your skin and the chair (<http://www.NickelAllergyFree.com>).

Some treatments involve topical steroids or oral corticosteroids, such as prednisone, which should be used as directed by a physician (MFMER, 2010). They will help with the dermatitis flare-ups but do not resolve the allergy. Calamine lotion may help with the itching. The ingredients in over-the-counter antibiotic creams may worsen the reaction (MFMER, 2010). Oral antihistamines such as fexofenadine (Allegra), cetirizine (Zyrtec), or diphenhydramine (Benadryl) may help itching (MFMER, 2010). Taking a vitamin C supplement and eating a diet rich in iron may help your body not to absorb the nickel you eat (Sharma, 2007).

A diet low in nickel can be helpful (Sharma, 2007). The eating habits of the person should be considered and the amount of nickel usually ingested tabulated. Providing similar foods with lower nickel contents will encourage the acceptance of a change in diet. Red wine, beer, and green teas should be avoided or used in moderation. Processed canned foods should be avoided if possible.

Animal products generally have less nickel content than plants; therefore, chicken, eggs, and meats are appropriate for a low nickel diet. Fish other than salmon, herring, tuna, and shellfish are acceptable (Sharma, 2007). Milk and milk products (cheese and butter) have a low nickel content. Foods from refined wheat or corn such as corn flakes and macaroni are allowed. Potatoes, cucumber, and cabbage are acceptable. Most mushrooms are safe. Bananas should be used in moderate amounts, but oranges and apples may be used as many as four times a week (Sharma, 2007). Utensils used to prepare foods should be free from nickel. Stainless steel utensils, when used in highly acidic foods, may have a release of nickel, which can increase the nickel content of the food (Sharma, 2007).

There is also work being done in the area of hyposensitization in nickel allergy by giving oral nickel sulfite to a nickel-sensitive person (Sharma, 2007). Researchers have noticed that hyposensitization (oral tolerance) can be obtained by stimulation of the suppressor T-cell production by antigen excess (Sharma,

2007). These studies are still in progress but look promising for the severely nickel-sensitive person.

There could also be some argument about screening for nickel allergy in a patient who is going to get a metal joint or stent placed during surgery (Jeswani & Alexander, 2011). Intracranial stents designed for the cerebral artery have a higher nickel content than the nickel in a stainless steel coronary stent (Jeswani & Alexander, 2011). Nickel allergy patients could be at higher risk for restenosis as a complication of these stents being used in them (Jeswani & Alexander, 2011). The decision to place a stent must be carefully thought out when treating patients with a significant nickel allergy. Surgical stainless steel that comprises surgical instruments has chromium, nickel, and molybdenum as parts of its content (Wikipedia, 2011). The nickel provides the smooth finish for the instrument. The surgical steel is also used for orthopedic implants, as part of an artificial cardiac valve, and other implants (Wikipedia, 2011). Immune system reaction to the nickel is a potential complication (Wikipedia, 2011). Titanium should be used, if available, if the implant is going to be a permanent one (Wikipedia, 2011).

### Importance for the GI Nurse and Associate

Gastrointestinal nurses and associates are advocates for our patients. If our patient comes in with a nickel allergy, what items in our facility could affect this patient in an adverse way? Typically, you would first place the patient on a stretcher for admission, procedure, and recovery. What are the side rails made of? They are metal. The framework of one brand, Narang stretchers, is made of anodized aluminum alloy. This is aluminum covered with another substance to make it harder and more resilient. From my research, there is no nickel in this. If the framework is stainless steel, even though there is nickel in it, there should be little or no problem with the patient touching the rails of the stretcher for the limited time of having an endoscopy procedure. As a precaution, the rails could be covered with a blanket so the patient wouldn't be in contact with the rails.

Next, typically you would obtain the patient's vital signs. The reusable blood pressure cuff could have metal on the connections to the cord. There are disposable ones on the market that have no metal on them. The stethoscope has metal on the bell that touches the patient when breath sounds are checked. Perhaps this could be covered during auscultation. A finger stick blood glucose test is needed. Is the lancet nickel-free? The ones we use are metal and probably have nickel, so exposure would need to be as limited as possible. Next, a catheter is placed for intravenous administration of

fluids for the procedure. This is a metal needle. One site said, “electropolished metal.” This means extra smooth for ease of insertion. The contact with the patient is minimal since the needle is removed and a plastic catheter is what remains. What is in the intravenous fluids you will start? According to the product insert, Lactated Ringers solution contains sodium chloride, sodium lactate, potassium chloride, calcium chloride, sodium, potassium, chloride, and lactate. If you have a specialty fluid, know the contents of that fluid before administering it to a patient with an allergy of any kind.

The patient is taken into the procedure room. Monitor electrodes are placed. If these are not metal free, the patient could have a localized skin reaction to these. A pulse oximetry probe is placed. Is there any contact with metal where this goes on the patient? Again, disposables are available for use with these patients.

What procedures are going to be performed on this patient? Will biopsy or snare removal of tissue be part of the procedure? The forceps and snare we use are made of surgical steel. The injector needle we use is made of surgical steel. Guidewires for dilators are surgical steel. Because surgical steel is composed of some nickel content, these should be used as efficiently as possible. While considered hypoallergenic for most people (MFMER, 2010), there are still risks involved when using it in a known nickel allergy patient. Will the patient require a clip? The Olympus Single Use Rotating Clip Fixing Device is made of surgical steel and has a warning printed in the manufacturer’s directions for use of the clip. The warning says, “As the clips are made of stainless steel, do not use them on a patient who is severely allergic to metals. Otherwise, allergic symptoms may occur” (Olympus, 2003).

Will a pH probe or Bravo capsule be placed? A call placed to Givens 1-800-TECH SUPPORT revealed that the trocar that attaches to the tissue is made of surgical steel. The recommendation was to err on the side of caution and not to use in a patient with a known metal/nickel allergy. The Bravo box insert user guide mini-CD does not include that information (Given Imaging, 2009).

What about the trocar for placing a percutaneous endoscopic gastrostomy tube? Or, the intraluminal stents we place in both the upper and lower GI tract. A number of the stents on the market are now made of “nitinol.” Nitinol is an alloy of nickel and titanium, both present about equally in the mixture. It is used for stents because of its elasticity and shape memory properties. The package insert for the Boston Scientific WallFlex Enteral Colonic Stent with Anchor Lock Delivery System has a warning section, which states: The stent contains nickel, which may cause an allergic reaction in individuals with nickel sensitivity (Boston

Scientific, 2009). These concerns may not be important to the outpatient who will have limited exposure to these items, but what about the inpatient who has more than one procedure over the course of his or her stay?

The procedure is completed and the patient is transported to the recovery area. Evaluate for any exposure risks here, again considering the side rails, the blood pressure cuff, and the stethoscope. Remove the cardiac electrodes as soon as possible. Will the patient be given nourishment before going home? If so, make sure that they are offered the appropriate choice of snacks and drinks to help keep them as nickel free as possible.

## Conclusion

Nickel is present in a vast amount of items we use every day in both our private and work environments. It is not possible to have a nickel-free environment because so many of our accessories are made of surgical steel or other metal of which nickel is a component. But we can make sure we know all of our patients’ allergies. We can make sure we know what our accessories are constructed from. We can make sure we read our user guides and are aware of warnings associated with our equipment and its use. We can limit patient exposures as much as possible. We are advocates and protectors of our patients. Our first role is to make sure that there is a safe environment for all of our patients to the best of our ability. ❖

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