WORKINGMAN BLUES: AN INTRODUCTION TO OCCUPATIONAL SKIN DISEASE

Kalman L. Watsky, M.D.
Clinical Professor of Dermatology
Yale School of Medicine
NECOEM 6 December 2019
OCCUPATIONAL SKIN DISEASE

- A national occupational research agenda priority research area
- 2014 BLS: 15.2% of all non-fatal occupational illnesses
- 4.6 cases/10,000 full time employees in Canada
- 2012: 32 cases/100,000; 33,300 reported cases, 16% of all occupational diseases

Warshaw et al. Dermatitis 2017;28:183-194
OCCUPATIONAL SKIN DISEASE

- Worker’s compensation claims range from 12 to 108 per 100,000 workers per year
- Estimated cost: $1 billion annually
- Research opportunities:
  - Epidemiology
  - Etiology
  - Prevention
  - Management of chronic contact dermatitis
OCCUPATIONAL SKIN DISEASE
CRITERIA FOR DIAGNOSIS

• Clinical appearance and distribution of rash;
• Workplace exposures to known irritants or allergens;
• Temporal relationship of skin condition to workplace exposures;
• Improvement in the condition when away from work;
• Exclusion of nonoccupational exposures;
• Confirmation of probable allergic cause by patch testing or other diagnostic test.

James S. Taylor, MD
OCCUPATIONAL SKIN DISEASE

- Contact dermatitis accounts for 90-95% of OSD, 80% irritant contact dermatitis
- 6-31% of patients referred for patch testing have occupational contact dermatitis (OCD)
- Atopics are at a 3-13.5x increased relative risk for OCD; 32% of patients with OCD are atopic
- 80% of cases involve hands; 10% face
OCCUPATIONAL SKIN DISEASE

- 15-20% of cases result in time lost from work: 1 day 24%, 2 days 17%, 3-5 days 27%, 6-10 days 14.5%, >10 days 17%
- 25% of patients with contact dermatitis will experience complete clearing; 75% have chronic or recurrent disease
- Spectrum of disease:
  - Contact dermatitis: irritant, allergic, urticaria
  - Chemical, physical, biological causes
  - Skin cancer

Burnett, Lushniak, McCarthy, Kaufman AJIM 1998
OCCUPATIONAL SKIN DISEASE

• Carriers of filaggrin gene mutations avoid professional exposure to irritants as adults.
• Loss-of-function mutations in FLG are associated with xerosis, atopic dermatitis, and early onset hand eczema.
• This Danish study found that 4/20 patients with FLG mutations were exposed to irritants vs 45/89 non-mutation carriers.

Contact Dermatitis 2013;69:355-362
OCCUPATIONAL SKIN DISEASE
WHAT IS ECZEMA/DERMATITIS AND WHEN WILL PATCH TESTING HELP IN DIAGNOSIS?

• ENDOGENOUS
  – Atopic
  – Seborrheic
  – Nummular
  – Stasis
  – Unclassified

• EXOGENOUS
  • CONTACT
    – Irritant
    – Allergic
  • PHOTO-CONTACT
    – Phototoxic
    – Photoallergic
  • CONTACT URTICARIA & DERMографISM
OCCUPATIONAL SKIN DISEASE
ALLERGIC CONTACT DERMATITIS

- Delayed-type hypersensitivity (Type IV) immune response mediated by cytokines released from activated lymphocytes; role of CD8+ effector cells & CD4+ Tregs
- Involves a low molecular weight hapten interacting with antigen presenting cells and T-cells; Th1 predominant; role of innate vs adaptive immunity
- Sensitization is facilitated by an impaired skin barrier
- The most common “loss-of-function” mutations in the filaggrin gene are R501X and 2282del4 and are associated with ichthyosis vulgaris, xerosis on the dorsal hands and hyperlinear palms.

Contact Dermatitis 2012;67:179-183
OCCUPATIONAL SKIN DISEASE
PRINCIPLES OF PATCH TESTING

• Test only with known substances in “standard” concentrations.
• Don’t test if the dermatitis is acute; wait 2 weeks after UV exposure; test off systemic corticosteroids if possible (20mg/d of prednisone diminished reactions in a group of Ni allergic pts.) and be cautious in interpreting results with other immunosuppressants.
• Patches should be in place for 2 days, at which time an initial reading is performed
• Delayed readings should be done on days 3, 4, and/or 7
• Contraindications to patch testing: pregnancy

Contact Dermatitis 2004;50:298-303 &
2010;62:165-169
OCCUPATIONAL SKIN DISEASE

• Material Safety Data Sheets (MSDS) are part of OSHA’s Hazard Communication Standard or Worker Right-to-Know law. They are prepared by the manufacturer without outside review.

• MSDSs should be on site. They may be obtained by health care providers directly from the manufacturer or from the employer with the employee’s permission.

• MSDS info on-line:
  – www2.ncsu.edu/ncsu/ehs/msds/index.html
  – www.cdc.gov/niosh/ipcs0000.html
OCCUPATIONAL SKIN DISEASE
Basic References/Bibliography

• Fisher’s Contact Dermatitis, Fowler & Zirwas, 7th edition, 2019
• Occupational Skin Disease, Adams
• Occupational and Industrial Dermatology, Maibach
• Textbook of Clinical Occupational and Environmental Medicine, Rosenstock & Cullen
OCCUPATIONAL SKIN DISEASE
THE ESSENTIAL HISTORY

• Time & primary site of onset
• Route & timing of secondary spread
• Occupation: title, time in position, what it involves precisely
• Change in condition in relation to work
• Cleaning and barrier techniques
• History of prior skin disease, esp atopy
• Whether fellow workers have similar sx(s)
OCCUPATIONAL SKIN DISEASE
SEVEN TIPS FOR SUCCESS

• Remember, your patient’s livelihood may be in jeopardy
• Take a careful history: think like Sherlock Holmes
• Try to make a precise diagnosis
• Consider a site visit
• Beware folie à deux (or more)
• Be prepared for legal issues, eg workman’s compensation
• Don’t expect cure, even with removal from the workplace
Hand dermatitis in co-workers: Is this work-related and if so, how?
OCCUPATIONAL SKIN DISEASE
SEVEN TIPS FOR SUCCESS

• Metal (stainless steel) grinder with acute airborne contact dermatitis
• Prior patch testing +: nickel, chromate, diazolidinyl urea, methylisothiazolinone, cutting oil
• Recent flare since starting a job at a different company
• MI in patient’s personal care products (shampoo and soap)
• Await MSDS
OCCUPATIONAL SKIN DISEASE

Contact Dermatitis in Hairdressers

• 51% of hairdressers develop hand dermatitis within 8 years of employment
• Atopy and nickel sensitivity were not predisposing factors but dry skin type was
• Irritant dermatitis is due to wet work, detergents and permanent wave solutions
• Most common causes of allergic contact dermatitis: GMTG 54%, paraphenylenediamine (active ingredient in hair dyes) 53%, nickel 30%
OCCUPATIONAL SKIN DISEASE
Contact Dermatitis in Hairdressers

- PPD-sensitive pts can safely handle previously dyed hair; nitrile gloves helpful
- 25% cross-react to semi-permanent dyes
- Possible cross-reactions to PABA, local anesthetics, sulfonamides
- Contact anaphylaxis & contact leukoderma also reported
- Rubber additives also important allergens

Fisher AA. Cutis 1989;43:316-318;
Contact Dermatitis 2015;72:229-236
OCCUPATIONAL SKIN DISEASE
Contact Dermatitis in Hairdressers

• Glyceryl monothioglycolate (GMTG): used in acid or hot permanent waves; common sensitizer

• GMTG persists in hair at least 3 months; 4H & neoprene gloves are protective

• Ammonium thioglycolate (ATG): used in home permanents; rare sensitizer not likely to cross react with GMTG
OCCUPATIONAL SKIN DISEASE
Contact Dermatitis in Hairdressers

- Nail technicians are at special risk for allergic contact dermatitis, especially to methacrylates.
- Photobonded acrylate sculptured nails are similar to new dental restorative materials.
- “No touch” techniques prior to polymerization limit risk.
OCCUPATIONAL SKIN DISEASE
Contact Dermatitis in Hairdressers

- A 63yo hairdresser with Type 1 latex allergy has a >5yr history of dermatitis that resolves out of work.
- Patch testing: PPD, GMTG, APS, Q-15, fragrance
- Files for disability.
Contact Dermatitis in Hairdressers

• A 41yo hairdresser & salon owner develops prednisone-resistant dermatitis.

• TrueTest: PPD only

• Patch Testing: PPD, GMTG, APS, nickel, Q-15, gold

• Avoidance effective
OCCUPATIONAL SKIN DISEASE
Contact Dermatitis in Hairdressers

• 18yo hairdresser
• Patch test positive to PPD, ammonium persulfate, nickel, and diaminotoluene
• Plans to retrain in real estate
OCCUPATIONAL SKIN DISEASE
Contact Dermatitis in Dental Professionals

• 37% (87/233) of dental workers report skin symptoms related to glove use; 4/87 had localized contact urticaria, the remainder had unclassified reactions by interview

• Potential allergens include rubber products, acrylates used in prostheses, disinfectants, essential oils, metals, rosin, topical meds

• Need to patch with extended series

Wrangsjo K et al. Contact Derm 1994;30:102-7
OCCUPATIONAL SKIN DISEASE
Contact Dermatitis in Dental Professionals

- Acrylates important in ACD:
  - bis-phenol A & glycidyl methacrylate
  - methylmethacrylate (MMA)
  - triethylene glycol dimethacrylate (TEGDMA)
- Uncured acrylic monomer is sensitizing; safe when completely polymerized
- Gloves may be protective; a trial of return to work with PPE is appropriate
OCCUPATIONAL SKIN DISEASE
Contact Dermatitis in Dental Professionals

- 45 yo dental assistant for 6 mos with a 3 mo hx of hand dermatitis.
- PT + to multiple dental acrylates, including 2-HEMA & TEGDMA
- Able to work wearing nitrile gloves providing 7 minutes of protection.
- Use specialty series if you suspect occupational contact dermatitis.
OCCUPATIONAL SKIN DISEASE
Contact Dermatitis in Dental Professionals

- 30 yo dentist with recurrent hand dermatitis
- Patch test positive to nickel only
- Dental drill DMG positive
Occupationally Related Nickel Reactions

- NACDG review 1998-2016 44,378 patients
- 18.2% positive to nickel sulfate 2.5%, 3.4% of these (268) had ORNA
- Hairdressers, machine operators, health care workers most frequent occupations.
- Equipment/instruments/phones, tools, and vehicles/machinery most common sources.

A 46yo non-atopic dental technician presents with a 1 yr history of hand dermatitis unresponsive to ultrapotent topical corticosteroids. TrueTest negative; treated with IMK, UVR.

- Patch tested with both a modified NACDG standard series & the dental series.
- Using a new dog shampoo.
OCCUPATIONAL SKIN DISEASE

Contact Dermatitis in Dental Professionals
OCCUPATIONAL SKIN DISEASE
Contact Dermatitis in Medical Professionals

• The one year prevalence of hand dermatitis in HCW is 21%, twice background; the cumulative incidence of hand dermatitis in hospital personnel is 30-40%

• Relative risk of hand dermatitis for nurses is 6.5 compared to office workers but 0.5 compared to hairdressers

• Dry skin is the most important endogenous risk factor; atopy confers a threefold risk and is the only factor significantly correlated with severity
OCCUPATIONAL SKIN DISEASE
Contact Dermatitis in Medical Professionals

• Irritants
  – cleansers, disinfectants, ethylene oxide, formaldehyde, foods, organic solvents, wet work

• Sensitizers
  – rubber gloves, formaldehyde, glutaraldehyde, fragrances, antibiotics, epoxy resin and acrylates
OCPPCATIONAL SKIN DISEASE
Contact Dermatitis in Medical Professionals

• Types of natural rubber latex reactions
  – irritant contact dermatitis
  – allergic contact dermatitis, type IV
    • >80% of occupational rubber allergy
    • reaction occurs 8 hours to 5 days after exposure
    • allergens: thiuram (72%), carbamates (25%), mercaptobenzothiazole (3%); also thioureas, Lowinox, BHA, latex (up to 1.2% of hand eczema, though should remain experimental: Wakelin el al. Contact Dermatitis 1999;40;89-93)
  – immediate-type hypersensitivity, type I

Geier et al. Contact Dermatitis 2012;67:149-156
OCCUPATIONAL SKIN DISEASE
Contact Dermatitis in Medical Professionals

Type I immediate reaction to latex protein
OCCUPATIONAL SKIN DISEASE
Contact Dermatitis in Medical Professionals

• 54yo veterinarian with a 1.5yr hx of hand dermatitis
• PT +: neomycin, fragrance, & glutaraldehyde
• Glutaraldehyde: a dialdehyde used in sterilizing solutions, especially in dentistry.
• Most common allergens in HCW: thiuram, carba, glutaraldehyde, cocamide diethanolamine, PCMX

Dermatitis 2008;19:261-74
1. 62 yo atopic medical assistant working in a Urology office notes worsening hand dermatitis. Only partial response to IMK.

2. Patch testing positive to glutaraldehyde only, used in cold sterilant in the office. Able to RTW with neoprene gloves.
OCCUPATIONAL SKIN DISEASE
Contact Dermatitis in Medical Professionals

- 52yo hospital dietitian w/ a 9 mo hx of hand dermatitis refractory to numerous topicals.
- PT: 2+ PTBF & 1+Ni
- Puts patient ID stickers on her fingertips for efficiency.
- 90% better with avoidance.
45yo hospital worker with persistent dermatitis on his abdomen.

Patch testing not done:

final diagnosis nickel allergic contact dermatitis
OCCUPATIONAL SKIN DISEASE
Contact Dermatitis in Manufacturing

• Soluble oil dermatitis in machinists
• Irritants (63%): metalworking fluids, cleansers, organic solvents
• Allergens (43%): metalworking fluids (biocides, colophony, MBT), nickel, cobalt, epoxy, preservatives
• Test soluble oils “as is” from the machine; use available oil & cooling fluid series

Grattan CEH et al. Contact Dermatitis 1989;20:372-376
OCCUPATIONAL SKIN DISEASE
Contact Dermatitis in Manufacturing

• Other allergens in metalworking
  – Alkanolamine borates, corrosion inhibitor; test 1% in buffer as alkalinity risks false positive reactions
  – Bioban P1487, formaldehyde releasing preservative; test 0.5% pet
  – Bronopol, preservative also present in skin-care products
  – Coconut diethanolamide, surfactant in cleansers and barrier creams; test 0.5% pet
  – Oleyl alcohol; test 10% pet
  – Neat cutting oils; due to epoxides, BHA, BHT
OCCUPATIONAL SKIN DISEASE
Contact Dermatitis in Manufacturing

- 48yo machinist with hand dermatitis that generalized
- Working with water based cutting oils.
- Patch test positive to propylene glycol, not a common allergen in metal working fluids (Contact Dermatitis 2008;59:261-267)
OCCUPATIONAL SKIN DISEASE
Contact Dermatitis in Manufacturing
OCCUPATIONAL SKIN DISEASE
Contact Dermatitis in Manufacturing

- No mention of propylene glycol on MSDS.
- Patch test to a sample of the cutting oil from the machine was negative.
OCCUPATIONAL SKIN DISEASE
Contact Dermatitis in Manufacturing

- The patient contacted the manufacturer of the cutting oil and found that propylene glycol was present at .26%.
- MSDS only are required to list ingredients present at concentrations >1%.
OCCUPATIONAL SKIN DISEASE
Contact Dermatitis in Manufacturing

- Latex, neoprene, nitrile, and PVC gloves provide no protection from propylene glycol.
- Safety 4H gloves may allow the patient to continue in his current position.
OCCUPATIONAL SKIN DISEASE
Contact Dermatitis in Manufacturing

• NACDG data 1998-2014
• 2732/39,332 (7%) of tested patients were production workers; 27% were machine operators
• 11% had a history of childhood eczema
• ACD 59%, ICD 33%; Hands and arms most affected
• Epoxy, thiuram/carba, formaldehyde, cobalt most common allergens

Warshaw et al. Dermatitis 2017;28:183-194
OCCUPATIONAL SKIN DISEASE
Contact Dermatitis in Construction

• Irritants: cement, chalk, acids, fiberglass
• Sensitizers: chromate, cobalt, epoxy resin, adhesives, woods
• Chromate Dermatitis
  – Irritant: chrome ulcer, especially moist surfaces
  – Allergic: often widespread & persistent
  – Hexavalent chromium in cement can be precipitated by ferrous sulfate
OCCUPATIONAL SKIN DISEASE
Contact Dermatitis in Construction

• Chromate dermatitis has a poor prognosis in the absence of strict avoidance
• 63/88 (72%) healed in 1-5 years with job change & strict avoidance in Swiss study
• Allergens in woodwork teachers include preservatives (BIT), nickel, epoxy resin, formaldehyde, and colophony
OCCUPATIONAL SKIN DISEASE

Contact Dermatitis in Construction

- 37yo cement vault worker; 1 yr history
- Patch test positive to carba, thiuram, epoxy, chromate, & nickel
- Job change necessary
OCCUPATIONAL SKIN DISEASE
Contact Dermatitis in Construction

- 38 yo man working in helicopter manufacture
- Recurrent hand dermatitis with secondary infection
- Patch test positive to epoxies in paint and chromate
- Improves but doesn’t clear with avoidance
Contact Dermatitis in Construction

- Surgeon with persistent facial eruption, thought related to surgical mask.
- Biopsy showed spongiotic dermatitis. Referred for patch testing.
- Does woodworking as a hobby.
- Colophony is the allergen in pine dust.

Watsky KL. Am J Contact Derm 1997
OCCUPATIONAL SKIN DISEASE
Contact Dermatitis in Construction

- 24yo automotive tech with a several month hx of hand dermatitis & autosensitization, worse with gloves. + Ni history.
- Patch testing positive for carba, thiuram, & Ni.
- Tools nickel plated, DMG +.
- Improves with vinyl gloves & Ni avoidance.
OCCUPATIONAL SKIN DISEASE
Contact Dermatitis in Printers

- 40 yo printer with hand dermatitis.
- Dental acrylates all negative.
- PT+ to pentaerythritol triacrylate from the printing acrylate panel.
- Specialized occupations demand specialized PT.
OCCUPATIONAL SKIN DISEASE
Contact Dermatitis in Printers

• NACDG data 1998-2014
• 132 (0.3%) of 39,332 patient were print machine operators, 85% printing press operators
• 56% had OSD, 58% ACD, 33% ICD
• Hands, arms, face, & scalp most affected
• Cobalt, rubber allergens, formaldehyde most common allergens

Warshaw et al. Dermatitis
2017;28:195-203
OCCUPATIONAL SKIN DISEASE
Contact Dermatitis in Florists

- Irritants: daffodils, narcissi, jonquils, Dieffenbachia, fertilizers, pesticides
- Allergens: Compositae, Primula obconica, tulips, Alstroemeria
- Tulip fingers: affects >14% of workers
  - dry, painful dermatitis with fissures under the free edge of the nail, may affect lids
  - tulipalin A allergen in tulips & Alstroemeria
OCCUPATIONAL SKIN DISEASE
Contact Dermatitis in Florists

Alstroemeria fingertip dermatitis

Palmar psoriasis in a florist
OCCUPATIONAL SKIN DISEASE

Contact Dermatitis in Florists

• Lily rash due to alkaloids in narcissus & daffodils; 90% irritant dermatitis

• Hyacinth itch caused by airborne calcium oxalate crystals from bulb tecta (outer layer)

• Alliaceae (eg garlic, onion) contain irritant sulphur compounds producing dermatitis of the 1st three fingers of the non-dominant hand, especially in cooks
OCCUPATIONAL SKIN DISEASE
Contact Dermatitis in Food Handlers

• Irritant contact dermatitis
  – esp garlic, onion, citrus, potatoes
  – often starts in web spaces

• Allergic contact dermatitis
  – onion & garlic most common food allergens; usually affects fingertips of non-dominant hand
  – capsicum, cinnamon, cloves, nutmeg and vanilla most common spice allergens
  – consider gloves, soaps, & cleansers
OCCUPATIONAL SKIN DISEASE
Contact Dermatitis in Food Handlers

• Systemic allergic contact dermatitis
  – can occur with allergy to spices
  – may see flare of original condition, rarely other reaction patterns

• Contact urticaria
  – immediate pruritus then edema & erythema
  – esp uncooked fish, seafood, occ onions, fruits, vegetables
  – IgE reaction, dx by skin prick testing; beware false positive reactions
OCCUPATIONAL SKIN DISEASE
Contact Dermatitis in Food Handlers

• Phototoxic reactions
  – from furocoumarins in celery, parsnip, parsley, figs, & lime

• Protein contact dermatitis
  – eczematous reaction 30 minutes after contact
  – esp seafood, onion, pork
  – diagnose by skin prick testing or use test on previously affected skin
OCCUPATIONAL SKIN DISEASE
Contact Dermatitis in Food Handlers

• Patch testing foods
  – garlic & onion: 10% aq or 50% in olive oil
  – test spices without dilution
  – test preservatives (parabens), antioxidants (BHA & BHT, octyl gallate), emulsifiers (propylene glycol), bleaching agents (benzoyl peroxide)
  – beware irritants, use controls
  – allergens may be inactivated by cooking
OCCUPATIONAL SKIN DISEASE
Contact Dermatitis in Food Handlers

Chef with atopic and irritant contact dermatitis

Chef with contact urticaria to shrimp

Chan EF & Mowad C. Am J Contact Derm 1998;9:71-9
OCCUPATIONAL SKIN DISEASE
Contact Dermatitis in Food Handlers

- 52yo man with hand dermatitis concerned about possible reaction to mold in ductwork.
- Hobbies: gardening and cooking
OCCUPATIONAL SKIN DISEASE
Contact Dermatitis in Food Handlers

- Patch testing positive to sesquiterpene lactone mix only.
- Grows artichokes