Update and Review of Common Occupational Skin Diseases

Susan Y. Chon, M.D.
Associate Professor
Department of Dermatology
UT MD Anderson Cancer Center
Disclosure Statement

I have no financial disclosures to report.
Overview

- History & Impact of OCD
- Anatomy and function of skin
- Types of occupational dermatoses
- Clinical presentation
- Evaluation, diagnostic tests, & treatment
History of OCD

• 100 A.D.- Celsus noted ulcerations in hands of metal workers

• 1700- Bernardin Ramzzzini published a detailed treatise on skin dermatoses experienced by 54 occupations including bath attendants, bakers, gilders, midwives, millers, and miners

• Late 19\textsuperscript{th} & early 20\textsuperscript{th} century-First laws to compensate workers for industrial skin diseases – Germany, then UK
Incidence of OCD

- Ranks 1\textsuperscript{st} among all occupational diseases in many countries

- US Bureau of Labor Statistics
  - 1970’s-mid 1980’s
    - 16.2 events/ 10,000 FT workers/year
    - 89,400 reported cases
  - 2007
    - 3.7 events/ 10,000 FT workers/year
    - 35,300 reported cases
  - Underestimated by 10-50 fold
Cost of OCD

- Direct and indirect costs of OCD in the U.S. is over $1 billion dollars a year
  - Medical costs
  - Worker’s compensation
  - Lost time from work

- Individual
  - Decreased earnings
  - Loss of work
  - Decreased QOL
Skin Anatomy

- **Epidermis** - stratified squamous epithelium
  - Keratinocytes
  - Melanocytes
  - Langerhan cells
  - Merkel cells

- **Dermis** - Supporting layer of collagen and elastic tissue with appendages
  - Hair
  - Sebaceous glands, sweat glands
  - Blood vessels & nerves
Skin function

• Barrier from the outside world
  – Chemicals
  – Mechanical friction
  – Water
  – Aerosolized substances

• Break down of this barrier by irritants or chemicals leads to a cascade of inflammation and injury → work-related dermatoses
Occupational Contact Dermatitis

- 80% - Irritant Contact Dermatitis (ICD)
- 20% - Allergic Contact Dermatitis (ACD)
Irritant Contact Dermatitis

- Direct cytotoxic effect on cells
- Disruption of the skin barrier
- Increased permeability and exposure
- Irritation and injury
- Condition is vastly underreported
**Allergic Contact Dermatitis**

- Type IV Delayed/ Cell-mediated hypersensitivity reaction
- Multistep process:
  - Sensitization
  - Elicitiation
- Chronic and lifelong
Common allergens & occupations
Nonoccupational exposure

- Domestic products- cleansers, detergents
- Personal skin care products- fragrances, hair products, moisturizers
- Pharmaceutical products- OTC and prescription
- Personal protective equipment- gloves
- Jewelry, clothing
- Hobbies, recreational activities
Most common contact allergens

- **Nickel**
  - metal in jewelry, clasps/buttons
- **Gold**
  - precious metal often found in jewelry
- **Balsam of Peru**
  - a fragrance used in perfumes and skin lotions, derived from tree resin
- **Thimerosal**
  - a mercury compound used in local antiseptics and in vaccines
Most common contact allergens

- Neomycin sulfate
  - a topical antibiotic common in first aid creams and ointments, also found occasionally in cosmetics, deodorant, soap and pet food
- Fragrance mix -- a group of the eight most common fragrance allergens found in foods, cosmetic products, insecticides, antiseptics, soaps, perfumes and dental products

Mayo Clinic, 2006.
Most common contact allergens

- Formaldehyde
  - a preservative with multiple uses, e.g., in paper products, paints, medications, household cleaners, cosmetics, and fabric finishes
- Cobalt chloride -- metal found in medical products; hair dye; antiperspirant; objects plated in metal such as snaps, buttons or tools; and in cobalt blue pigment

Mayo Clinic, 2006.
Most common contact allergens

- Bacitracin
  - a topical antibiotic
- Quaternium 15
  - preservative found in cosmetic products such as self-tanners, shampoo, nail polish and sunscreen or in industrial products such as polishes, paints and waxes

Mayo Clinic, 2006.
2016 Allergen of the year: Cobalt

• Used in steel requires high strength and endurance
• Tools, vehicle engines, magnets, orthopedic and other medical devices
• Common sensitizers nickel, gold, chromium, palladium
• 7.3% in U.S. are reactive
  – 60% are allergic to nickel
Most common industrial agents

- Chromates (cement workers)
- Resins (plastic industry)
- Acrytics
- Nickel
- Dyes
- Rubber
- Glues
- Soaps and cleansers
- Wet work
High risk occupations

• Petrochemical
• Rubber
• Plastic
• Metal
• Automotive
• Healthcare workers
• Food industry
Clinical features
Common signs and symptoms of ICD

• Acute
  – erythema
  – edema
  – pain, burning
  – erosion

• Chronic
  – thickening
  – hyperkeratosis/scaling
  – fissures
ICD of hands: Presentation

- Eczematous eruption
- Primarily fingers, dorsum of hands
- Usually spares the palms
- Presentation
  - Itchy, sore skin
  - Ill-defined rough, scaly, erythematous patches
- Occupation
  - Hairdressers – apprentice
  - Beauticians/cosmetologists
  - Healthcare workers
  - Restaurant industry
  - Cleaners
  - Mechanics
Chronic: Presentation

- Lichenified - thickened, accentuated skin lines
- Itchy
- Fissured
ACD: Presentation

• Presentation
  – Intense history of irritation, vesicles, & weeping

• Clues
  – Distribution of eruption
  – History of exposure
ACD- Poison ivy, oak, or sumac

- Urushiol- irritating oily sap
ACD

- Topical antibiotic ointment - often post procedure
- Neomycin
- Bacitracin

- Clues
  - Temporal relationship
  - Red juicy appearance
  - Vesicles
  - Well-demarcated
ACD

• “Outside job”
• Occurs on exposed skin

• Clues
  – Temporal relationship
  – Linear arrangement
  – Vesicles
  – Well-demarcated
ACD

• ACD to jewelry-nickel

• Clues
  – Temporal relationship
  – Recurs with repeated exposure
  – Improves when jewelry discontinued
  – Nickel hypersensitivity

• Dimethylgloxime test
ACD

- ACD to aerosolized substance
- Pollens, chemicals, particles
- Clues
  - Temporal relationship
  - Exposed areas of the skin
  - Neck, v of chest, hands, lower legs
Clinical Features of OCD

- Symptoms
  - Minor irritation → Intense discomfort, itching, pain
- Physical exam
  - Distribution consistent with exposure
  - Erythema, +/- vesicles
Clinical Features of OCD

• Distribution compatible w/ exposures at work

• Temporal relationship with onset and withdrawal of offending agent
  – improvement on weekends & holidays away from work

• Other co-workers affected
Exacerbating factors

- **Host factors**
  - Age: young and elderly
  - Race: darker pigmented patients are less affected
  - Sex: women > men, increased exposure
  - Pre-existing skin disease or injury
    - eczema 13.5x more likely to develop ICD, maceration
  - Anatomic location: 80% hands, 10% face
  - Sebaceous activity
Exacerbating factors

- Environmental factors
  - Concentration
  - pH
  - Mechanical pressure
  - Temperature
  - Duration of contact
  - Excess humidity
  - Under occlusion
Chronic occlusion--ICD

- Chronic moisture under work boots
- Breakdown of skin barrier
Chronic ICD

- Nail salon worker >20 years
- Loss of fingerprints
- Work with files, solvents, emollients

What is an ID reaction?

• Autosensitization
  – secondary reaction of the skin to a primary contact dermatitis at another site on the body

• Physical exam
  – Primary rash on hands
  – Leads to id response on the face or other areas that have been traditionally covered and not exposed (antecubital fossae)
What is an ID reaction?

• Primary reaction
  – Correlates to exposure sites

• ID reactions
  – Distant from primary insult
  – Patch tests
Evaluation and Diagnosis

- Take and retake a thorough history
  - Social, personal, and work related exposures
  - Consider reviewing the MSDS/SDS

- Gold standard: Refer for patch testing
Epicutaneous Patch Testing

- Gold standard to detect Type IV delayed hypersensitivity reaction

- Requires a minimum of 3 visits
  - Placement of the patch tests
  - Read at 48 hours for irritant effect
  - Read at 96 hours for ACD
T.R.U.E. Test

- Thin-layer Rapid Use Epicutaneous Test
- Manufactured by Allerderm
- Limited to 36 allergens, preset
- Only FDA approved patch test
ACDS recommends Extended Patch Testing

- Core Allergen series
- 80 allergens with extra panels
- 70-80% sensitivity and specificity
### Patch test for contact dermatitis

#### TABLE 1. ACDS Recommended Allergen Series

<table>
<thead>
<tr>
<th>Core Allergen Panel I</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Nickel sulfate 2.5% pet*</td>
</tr>
<tr>
<td>2. Myroxylon pereirae 25% pet*</td>
</tr>
<tr>
<td>3. Fragrance mix 18% pet*§</td>
</tr>
<tr>
<td>4. Quaternium 15 2% pet*</td>
</tr>
<tr>
<td>5. Neomycin 20% pet*</td>
</tr>
<tr>
<td>6. Budesonide 0.1% pet*</td>
</tr>
<tr>
<td>7. Formaldehyde 1% aq*§</td>
</tr>
<tr>
<td>8. Cobalt chloride 1% pet*§</td>
</tr>
<tr>
<td>9. $p$-tert-Butylphenol formaldehyde resin 1% pet*</td>
</tr>
<tr>
<td>10. $p$-Phenylenediamine 1% pet*</td>
</tr>
</tbody>
</table>

#### Core Allergen Panel II

11. Potassium dichromate 0.25% pet*§
12. Carba mix 3% pet*§
13. Thiuram mix 1% pet*          
14. Diazolidinyl urea 1% pet*    
15. Paraben mix 12% pet*         
16. Black rubber mix 0.8% pet*   
17. Imidazolidinyl urea 2% pet*  
18. Mercapto mix 1% pet*         
19. Methylchlorisothiazolinone/methylisothiazolinone 100 ppm aq* 
20. Tixocortol-21-pivalate 1% pet* 

#### Core Allergen Panel III

21. Mercaptobenzothiazole 1% pet* 
22. Colophony 20% pet*          
23. Epoxy resin 1% pet*         
24. Ethylenediamine dihydrochloride 1% pet* 
25. Lanolin alcohol (Amerchol 101) 50% pet 
26. Benzocaine 5% pet†          
27. Bacitracin 20% pet*         
28. DMDM hydantoin 1% pet       
29. Dibucaine 2.5% pet          
30. Parthenolide 0.1% pet*      

* Denotes petrolatum vehicle
§ Denotes with white petrolatum
† Contains irritant vehicles
Patch test for contact dermatitis

Core Allergen Panel IV
31. 2-Bromo-2-nitropropane-1,3-diol 0.5% pet *
32. Lidocaine 15% pet
33. Gold sodium thiosulfate 2% pet*
34. Methylidibromoglutaronitrile 0.5% pet*
35. Disperse blue 106/124 mix 1.0% pet†*
36. Hydrocortisone-17-butyrate 1% pet*
37. Fragrance mix II 14% pet
38. Iodopropynyl butylcarbamate 0.1% pet§
39. Methylisothiazolinone 0.2% aq
40. Cocamidopropyl betaine 1% aq§

Core Allergen Panel V
41. Mixed dialkyl thioureas 1% pet
42. 3-(Dimethylamino) propylamine (DMAPA) 1% aq
43. Hydroxyethyl methacrylate 2% pet
44. Oleamidopropyl dimethylamine 0.1% aq
45. Decyl glucoside 5% pet
46. Methyl methacrylate 2% pet
47. Propylene glycol 30% aq
48. Cinnamic aldehyde 1% pet
49. Amidoamine 0.1% aq
50. Ethyl acrylate 0.1% pet

Core Allergen Panel VI
51. Tea tree oil 5% pet
52. Chlorhexidine digluconate 0.5% aq
53. Chloroxylenol (PCMX) 1% pet
54. Propolis 10% pet
55. 2-hydroxy-4-methoxybenzophenone (benzophenone-3) 10% pet
56. Tosylamide formaldehyde resin 10% pet
57. Sesquiterpene lactone mix 0.1% pet
58. Cocamide DEA 0.5% pet
59. 4-Chloro-3-cresol (PCMC) 1% pet
60. Benzalkonium chloride 0.1% pet§
**Patch test for contact dermatitis**

<table>
<thead>
<tr>
<th>Core Allergen Panel VII</th>
</tr>
</thead>
<tbody>
<tr>
<td>61. 2-Hydroxy-4-methoxybenzophenone-5-sulfonic acid (benzophenone-4) 2% pet</td>
</tr>
<tr>
<td>62. Triclosan 2% pet</td>
</tr>
<tr>
<td>63. Sorbic acid 2% pet</td>
</tr>
<tr>
<td>64. Ylang ylang 2% pet</td>
</tr>
<tr>
<td>65. Compositae mix II 5% pet</td>
</tr>
<tr>
<td>66. Ethyleneurea melamine-formaldehyde 5% pet</td>
</tr>
<tr>
<td>67. Sorbitan sesquioleate 20% pet</td>
</tr>
<tr>
<td>68. N,N-Diphenylguanidine 1% pet</td>
</tr>
<tr>
<td>69. Cetyl steryl alcohol 20% pet</td>
</tr>
<tr>
<td>70. Glutaraldehyde 1% pet</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Core Allergen Panel VIII</th>
</tr>
</thead>
<tbody>
<tr>
<td>71. Triamcinolone 1% pet</td>
</tr>
<tr>
<td>72. Clobetasol-17-propionate 1% pet</td>
</tr>
<tr>
<td>73. DI Alpha Tocopherol 100%</td>
</tr>
<tr>
<td>74. Ethyl cyanoacrylate 10% pet</td>
</tr>
<tr>
<td>75. Phenoxyethanol 1% pet</td>
</tr>
<tr>
<td>76. Disperse Orange 3 1% pet</td>
</tr>
<tr>
<td>77. Jasminium officinale oil 2% pet</td>
</tr>
<tr>
<td>78. 2, 6-Diterb-butyl-4-cresol (BHT) 2% pet</td>
</tr>
<tr>
<td>79. 2-Ethylhexyl-4-methoxycinnamate 10.0 pet</td>
</tr>
<tr>
<td>80. Benzyl alcohol 10%</td>
</tr>
</tbody>
</table>
Evaluation and Diagnosis

- If any allergens found to be positive, recommend avoidance of allergens and all cross-reacting allergens.
  - American Contact Dermatitis Society (ACDS) has a Contact Allergen Management Program (CAMP)
    - Reference lists on products to avoid and use
    - Patient education and information
  - [www.contactderm.org](http://www.contactderm.org)
Treatment: Restore Barrier Function

• Avoid exposure to possible irritants and allergens
• Discontinue all topicals
• Start a mild skin care regimen
  – Mild, non-soap cleansers (cetaphil)
  – Short lukewarm showers
  – Emollients – bland creams and ointments
    • Vanicream, Cerave cream
    • Aquaphor
    • Shea butter
Treatment - Hand Foot involvement

- Avoidance of suspected irritant or antigen
- Wear protective cotton lined or flocked gloves, drymax or wool socks
- May need to change socks at work
- Change shoes daily
- Avoid heat and friction
Prescription Treatment

• Topicals
  – Body: BID for 2-3 weeks, taper
    • Mid to high potency topical steroid
    • Mid: Triamcinolone 0.1% oint
    • High: Clobetasol 0.05% oint
  – Face/neck/groin: BID 2-4 weeks, taper
    • Hydrocortisone 2.5% oint
    • Triamcinolone 0.025% oint

• Antihistamines
  • Benadryl, Zyrtec, Allegra
  • Hydroxyzine 10-25mg, Doxepin 10
Prescription Treatment

• Topicals
  – Topical immunomodulators (steroid sparing), usually 6 weeks
    • Pimecrolimus 1% cream
    • Tacrolimus 0.3 or 0.1% oint
  – Antibiotic ointment
    • Bactroban ointment

• Antihistamines
  • Benadryl, Zyrtec, Allegra
  • Hydroxyzine 10-25mg, Doxepin 10
**Treatment**

- **Wet wraps**
  - Apply topical steroid to affected areas.
  - Use warm towels to wrap areas for 10 minutes.
  - Repeat 2-3 times a day.
- **Consider oral antibiotics if infected.**
- **Consider oral corticosteroids if severely affected, inability to perform ADL.**
- **Systemic treatments**
  - PUVA, UVB light therapy.
  - Immunosuppressants - MTX, azathioprine, CSA.
Maintenance and Prevention Strategies

• Be proactive
• Regularly use thick, alcohol-free emollient on dry areas at least once daily-Vanicream, Cerave cream, Cetaphil cream
• Avoid sunlight exposure, harsh wind, harsh soap, perfume, and tight-fitting clothing
  – Rash can be more severe in areas exposed to sunlight
  – Wear protective clothing
• Water-based makeup is well tolerated, can be used to camouflage rash
Maintenance and Prevention Strategies at the Workplace

- Involve workplace to modify exposure
- Improve shielding, with special work clothes, gloves, goggles, masks
- Pre exposure - emolliate and maximize barrier integrity
- Post exposure -
  - Wash immediately to remove possible irritants with mild non-soap cleansers. Avoid sanitizing gels.
  - Dry thoroughly
  - Don’t wear rings
  - Emolliate
- Increase awareness at workplace
Dermatology Consultation

• Goals
  – Work with the primary team to assess extent, severity and impact of the OCD
  – Accurately diagnose and assess the possible causes of the OCD
  – Treat and improve the quality of life of the patient
  – Help maintain employment for the patient
Patient Education

• Patient education about cutaneous toxicities is essential for optimal patient compliance and management of OCD

• Information for patients
  – Can improve QOL
  – Treatment and prevention strategies

• Patient education should ideally occur
  – When appropriate family members/caregivers are also present

• Written information and handouts
Summary

• Occupational Contact Dermatitis is an exceedingly common medical disease with high cost to society and the individual
• Accurate assessment and evaluation by an occupational health provider and dermatologist can improve the quality of life and maintain an individual’s ability to work
• Continued follow up and involvement is essential as relapses due to reexposure or crossreactive agents is common
Every worker has the right to come home safely at the end of every day. They shouldn’t be coming home and getting sick.

-Dr. David Michaels
Assistant labor secretary
Head, Occupational Safety and Health Administration
Thank you!