Introduction to Contact Dermatitis & Patch Testing

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What is contact dermatitis

Rash after contact with chemical agent

• **Irritant (ICD)** = 80% of reactions *(everyone!)*

• **Allergic (ACD)** = 20%
  - requires sensitization
  - Delayed-type IV hypersensitivity Rxn
Contact Dermatitis

**Irritant** (80% cases) or **Allergic** (20% cases)
(everyone gets it) (only those “sensitized”)

**Irritant** – florist example
- Daffodils – Ca oxalate
- Poinsettia – Phorbol ester

**Allergic** – florist example
- Peruvian Lilly - Tuliposide A
- Chrysanthemum - Sesquiterpene lactone
**Allergic** Contact Dermatitis

Why the heck it matters

If exposure avoided, rash will go away!
Allergic Contact Dermatitis
4 Key Points

• Poison ivy is the classic example of ACD

• > 4,000 environmental allergies known to exist

• True allergic contact dermatitis (ACD) can develop even years after continued exposure to something

• “Relevance” is the key to patch testing results
Detergent “allergies”: An urban legend

• J Am Acad Dermatol 2003;49:161

• J Am Acad Dermatol 2002;46:200
  (0.7% incidence likely too high = false + ICD)
Patch Testing Phases
(The Dermatologist, November 2013)

• Pre-testing

• Interim-testing

• Post-patch education phase
I. Pre-testing Phase

• **Location** of rash?

• **Work/Hobbies**?
  • Other family members or co-workers with rash?
  • Did you have rashes as a child (atopic eczema)?
  • History of seasonal allergies/hay fever/asthma?

• **What treatments (topical/oral/shots) used**?

• Are you suspicious of anything causing rash?
Location, Location, Location

- Regional Atlas of Contact Dermatitis
  (Lewallen & Feldman MD, The Dermatologist)

- Hands
- Face
- Scalp
- Eyelids
- Mouth, lips and perioral
- Neck
- Extremities
- Feet
- Anogenital
Work & Hobbies?
Skin & Aging, NOV 2011 (see table p. 24)

- Food handlers
- Hairdressers
- Manicurists
- Construction/Manufacturing
- Soldiers
- Farmers
- Hospital workers
- Gardeners
- Lab technicians
- Industrial workers
- Cobblers
- Dental workers
- Metalworkers
- Paper processing workers
- Massage therapists/aromatherapists
Stopping Systemic Steroids Prior to Patch Testing

Joseph Fowler, U L’ville
Dermatitis 2009;20:265

1) Ideally, STOP systemic steroids 3-4 wks prior

2) If unable to stop, lower to 10mg/d or less, or QOD dosing

3) If severe, Rx prednisone 40-60mg/d, stop 3 days
II. Interim-testing Phase  
(The Actual Patch Testing)

• Ensure TRUE Test stored properly & not expired
• Apply correct side up
• If using Finn chamber –ensure uniform amount
• Upper back placement ideal
• Avoid placing over active rash areas
• If recent sunburn to area, avoid for at least 3 weeks
• No shifting/lifting of TRUE Test or Finn chambers
II. Interim-testing Phase
(The Actual Patch Testing) – cont’d

• **1st 6 hours**: Minimize movement and stay dry!
• Also keep dry remainder of time patches are on.
• No showering/bathing/swimming x 48 hours
T.R.U.E. Test
Thin-layer Rapid Use Epicutaneous Patch Test

• 35 allergens = FDA approved expansion 2012
• Placed on non-inflamed skin of upper back

• Removed 48 hours – 1st reading
• Day 4 to 7 – 2nd reading
T.R.U.E. Test
Thin-layer Rapid Use Epicutaneous Patch Test
Patch Tests – TRUE Test Series
Patch Tests – Expanded Series
Allergens loaded onto Finn Chambers
Patch Test Reactions
T.R.U.E.
Thin-layer Rapid Use Epicutaneous Patch Test

**Extreme positive**
Coalescing vesicles; bulla

**Strong positive**
Erythema; papules; infiltration; discrete vesicles

**Weak positive**
Erythema; infiltration; discrete papules

**Doubtful**
Faint or homogenous erythema; no infiltration

**Irritant**
Discrete, patchy or homogenous erythema; no infiltration
• Panel 1.2
  Nickel sulfate
  Wool alcohols
  Neomycin sulfate
  Potassium dichromate
  Caine mix
  Fragrance mix
  Colophony
  Paraben mix
  Negative control
  Balsam of Peru
  Ethylenediamine dihydrochloride
  Cobalt Dichloride
Panel 2.2 - * = new in 2012

- p-tert-Butylphenol formaldehyde resin
- Epoxy resin
- Carba mix
- Black rubber mix
- Cl+ Me- isothiazolinone (MCI/MI)
- Quaternium-15
- *Methyldibromo glutaronitrile (MDBGN)- preservative
- p-Phenylenediamine
- Formaldehyde
- Mercapto mix
- Thimerosal
- Thiuram mix
Panel 3.2  - * = new in 2012

Diazolidinyl urea
Quinoline mix
Tixocortol-21-pivalate (Class A steroid)
*Gold sodium thiosulfate (GST) - metal
Imidazolidinyl urea
Budesonide (Class B steroid)
*Hydrocortisone-17-butyrate (Class D steroid)
Mercaptobenzothiazole
*Bacitracin - antibiotic
*Parthenolide - plant allergen (from feverfew & in skin care products)
*Disperse blue 106  - azo dye
*2-Bromo-2-nitropropane-1,3-diol (Bronopol)
(antimicrobial agent/preservative)
Patch Testing
“Late Reactors”

- Paraphenylenediamine
- Neomycin
- Tixocortol Pivalate (Class A “Hydrocortisone type”)
- Gold (all metals)
III. Post-patch Education Phase (Relevance?)

• List of where the allergens are found (TRUE Test web site)

• List of acceptable alternatives (substitutes)
Resources

• Contact Allergen Management Program (CAMP)  
  *American Contact Dermatitis Society*

• Contact Allergen Replacement Database (CARD) 
  *Mayo Clinic*

* Enter allergen/s and provide list of alternatives*
“Use Test”
- practical screening tool for allergens -

• Apply product volar forearm BID x 3 days

• No rash? Probably “ok”
Top 15 Contact Allergens
Dermatitis Jan-Feb 2013

- Nickel
- Myroxylon pereirae (Balsam of Peru)
- Neomycin
- Fragrance mix I
- Quaternium-15
- Cobalt chloride
- Bacitracin
- Formaldehyde*
- Methyl dibromo glutaronitrile
- Paraphenylenediamine
- Propolis
- Carba mix
- Potassium dichromate
- Fragrance mix II
- MCI/MI

- Metals
- Fragrance components
- Preservatives
- Topical antibiotics
- Permanent hair dyes
- Rubber
- Botanicals
“Allergen of the Year”
American Contact Dermatitis Society

- 2015 - Formaldehyde
- 2014 - Benzophenones
- 2013 - Methylisothiazolinone
- 2012 - Acrylate
- 2011 - Dimethyl fumarate
- 2010 - Neomycin
- 2009 – Mixed dialkyl thioureas (Neoprene rubber is a common source.)
- 2008 – Nickel
- 2007 – Fragrance
- 2006 – p-Phenylenediamine
- 2005 – Corticosteroids*
- 2004 – Cocamidopropyl betaine
- 2003 – Bacitracin*
- 2002 – Thimerosal
- 2001 – Gold
Topical Steroids & ACD

Class A (2.7%) – Hydrocortisone Type

Tixocortol Pivalate (test allergen)
Includes oral steroids

Class B (1.5%) – Acetonides (& related) Type

Budesonide (test allergen)
Triamcinolone acetonide, Fluocinonide, Desonide

Class D (0.8%) – Esters

D1 (halogenated less labile) Betamethasone valerate, clobetasol propionate

D2 (more labile prodrug) HC-17 butyrate (test allergen)

*Class A,B,D can cross react!!!!!!!!!!!

Class C (<0.2%) – Betamethasone Phosphate (not valerate)

No cross rxn w/ A, B, D, so far less allergy
Desoximetasone (Topicort), Clocortolone pivalate (Cloderm) = devoid of ACD!
Formaldehyde
2015 Allergen of the Year

• Preservative (bx & cadaver sol, nail polish, “Brazilian blowout Rx”, wrinkle-free fabrics)

• Formaldehyde releasing preservatives (FRP): personal hygiene products (PHP), medications, household cleaners
  - 20% of PHP contain them (good intention gone bad!)
    (#1 = imidazolidinyl urea)

• 1/3 moisturizers do NOT list formaldehyde/FRP status
Benzophenones
2014 Allergen of the Year

• chemical ultraviolet light absorbers used in products ranging from **sunscreens** and hair sprays to plastic lens filters for color photography
Methylisothiazolinone (MI)  
2013 Allergen of the Year

• Increasingly used alone as preservative rather than in combo w/ methylchloroisothiazolinone (MCI)  
current testing uses MCI/MI mix, can miss 30-60% who are truly allergic to MI

• Cosmetics, sunscreens, toiletries

• Facial, perianal *(baby wipes)*, genital, hands

• May cause pseudolymphoma change perianal/genital

• Damaged (dermatitis/sunburn) & thin skin sites
Baby Wipe Allergy
-Hurried Parents Cleaning Faces-
Acrylates
2012 Allergen of the Year

• “Everywhere”

• First used in Plexiglas, these compounds have a wide range of applications, including: paints, adhesives, dental composite resins, printing inks, and artificial nails. Acrylates also are used in a number of medical devices, including contact lenses, hearing aids, and bone cement for orthopedic endoprostheses.
Acrylates – artificial nail allergy
Dimethyl Fumarate
2011 Allergen of the Year

• a volatile substance included in shipments of **furniture**, **clothing**, and **shoes** to inhibit growth of mold
Dimethyl Fumarate Furniture – “sofa dermatitis”
Neomycin
2010 Allergen of the Year

• **OTC Antibiotic**
  (including eyedrops)

• Rash often up to 1 week after contact

• Present in many vaccines
Mixed Dialkyl Thioureas
2009 Allergen of the Year

• common additives found in everyday **neoprene synthetic rubber products** - everything from computer mouse pads to shoes, athletic braces and wetsuits.
Neoprene Allergy
Plant Dermatoses

• **Allergic** Contact Dermatitis

• **Irritant** Contact Dermatitis (chemical, physical)

• Contact **Urticaria** (toxin-mediated, immunologic) (Hives)

• **Phototoxic** (Phytophotodermatitis)
Allergic Contact Dermatitis
Anacardiaceae (Toxicodendron genus)

- Poison ivy, oak, sumac “Rhus Dermatitis”
  > Sensitizer: Catechols – urushiol oleoresin
    “Black dot dermatitis” (urushiol melanizes w/ O2)
    * Vinyl gloves protective (but not nitrile)*

Also in family: Brazilian pepper, cashew, Japanese lacquer tree, mango peel, Indian nut tree, black varnish tree, ginkgo
Poison Ivy
(California spared in continental U.S.)

Western

Eastern
Poison Sumac

^ Mississippi River & boggy Southeast
Poison Oak

Pacific

Atlantic
Poison Ivy: fact or fiction?

• Blister fluid spreads the rash? false
• Blisters are contagious? false
• You can’t get it in winter? false
• Some people never get it? true
• You can get it from your dog? true
Poison Ivy????
No Problem!

15-30% of people do NOT react
Allergic Contact Dermatitis to poison ivy
Type IV (Delayed-Type) T-cell Hypersensitivity

- Antigen (urushiol) on skin
  - processed by epidermal Langerhans cells
  - presented to T cells, \(^ \# \) of reactive T cells

- Rash 1-4 days after exposure
- Can last 7-21 days
Urushiol

• **Oil** found in *Toxicodendron* genus (poison ivy, oak, sumac)

• Found in leaves, vines in *all seasons*

• Pattern and degree of reaction depends on
  - amount of urushiol
  - host immune factors
  - thickness of skin
Allergic contact dermatitis to poison ivy (linear “streaks” are often clue)
Allergic Contact Dermatitis
Treatment

Avoid/remove exposure to allergen

If known exposure, wash within minutes - soap/water

Limited (<10% body) Rx topical steroid, oral antihistamine

Widespread/face/genitals – Consider Rx systemic steroids!

Beware of continued exposure: poison ivy on residue pets/clothes
Allergic Contact Dermatitis

**Compositae Family (Asteraceae)**

- Chrysanthemum, ragweed, daisy, sunflower, dandelion, marigold, pyrethrum, feverfew, chamomile, liverwort, sagebrush, chicory, endive, tarragon, artichoke

- Sensitizer: **Sesquiterpene lactone**

- Present in **tea tree oil** (allergen: d-limonene)

- **Permethrin** is made from chrysanthemums
Allergic Contact Dermatitis (Cont’d)

Alstroemeria (Peruvian Lily, *Alstroemeria*)
sensitizer: Tuliposidase A

Liliaceae (Tulip, Asparagus, Hyacinth)
sensitizer: Tulipalin A

The most frequent allergens in florists:

- Tuliposide A (Peruvian Lily, *Alstroemeria*)
- Sesquiterpene lactone (Chyrsanthemum/Asteraceae)
Most common **allergens** in flowers

*Tuliposide A* in Peruvian Lilly

*Sesquiterpene lactone* in Chrysanthemums
Top 10 Denials for Contact Dermatitis Dx

- It’s “hypoallergenic”
- I never put the item at that location
- I don’t have “allergies”
- I’m too old to develop this now
- It’s “inert”
- It’s just my eczema
- I haven’t used it for several days
- I only used a little of it
- I’ve used it for years without a problem
- It’s “all natural”
Irritant Contact Dermatitis

Chemical

• Family Amaryllidaceae
  > **Daffodil** (narcissus) = **#1 dermatitis in florists**!
    - irritant: **calcium oxalate**

• Family Araceae – “**dumb cane**” (dieffenbachia picta)
  > house plant + moisture = edema, blisters, hoarseness
    - irritant: calcium oxalate

• **Pineapple**
  - irritant: calcium oxalate, bromelin
Irritant Contact Dermatitis
Chemical

• Family euphorbiacea – **Poinsettia**
  > irritant: Phorbol ester

• Family alliaceae – **Garlic, Onion, Chive**

• Family brassicaceae – **Mustard, Radish**
  > irritant: Thiocyanates
Contact Urticaria (hives)

I. Non-immunologic: Toxin-mediated (no sensitization)
   > Stinging Nettle (urtica dioica)
     - trichome hairs > histamine, serotonin, Ach

II. Immunologic: Prior sensitization required
   > Many plants – celery most common
   > Latex (rubber tree plant = Hevea brasiliensis
     * cross rxn: avocado, banana, chestnut, kiwi
   > More common in atopic pts.
Stinging Nettle
Non-immune Contact Urticaria (hives)
Stinging Nettle throughout U.S. (Rare in Arkansas)
Stinging Nettle Contact Urticaria (Hives)
Phototoxic (phytophotodermatitis)

- **Marked sunburn response**
- Direct injury after UVA activation of agent
- No prior allergic sensitization
- Erythema/edema after 24 hours, leaves PIH (post inflammatory hyperpigmentation)
- Plants containing furocoumarins
Phototoxic (phytophotodermatitis)

- Apiaceae family *(Umbilliferae)* = #1 cause
  - dill, wild carrot, **celery**, rhubarb, **hogweed**, fennel, parsley, **parsnip**, angelica, wild chervil (vegetable/umbrella family)

> sensitizer: **Furocoumarins**

> “Strimmer/weed eater dermatitis”
Plant Phototoxicity (Phytophotodermatitis) “Strimmer” or “Weedeater” Dermatitis

*Residual Hyperpigmentation lasts months*
Big, Beautiful and Blister Inducing, Giant Hogweed Shows Its True Colors Around Vermont

Local Matters
BY KEN PICARD [07.20.11]
July 19, 2016:

State Officials say “Poison” Parsnip can Cause Serious Burns
Parsnip
If you get wild parsnip sap on your skin:
• Wash the skin thoroughly with soap and water as soon as possible.
• Protect the exposed skin from sunlight for at least 48 hours.
• If you experience a skin reaction, call your health care provider.

If you need to work with or near the plant:
• Wear clothing that covers your arms and legs.
• Wash clothes that come in contact with the sap.
• Work with the plant on cloudy days.
• If you are using string trimmers or power mowers in areas where this plant grows, wear eye/face protection, in addition to long pants, long sleeves, and gloves.
Phototoxic (Phytophotodermatitis)

- Rutaceae family - #2 cause ("citrus family")
  - lemon, lime, grapefruit, orange, blister plant, gas plant, rue, burning bush, bergamot orange, Hawaiian lei flowers (mokihana), sandalwood

- sensitizer: Furocoumarins

- Berloque dermatitis – perfume w/ oil of Bergamot (5-MOP)
Plant Phototoxicity (Phytophotodermatitis)

Citrus: Limes

Acute - blisters          Residual - hyperpigmentation

Plant Phototoxicity