

American Contact Dermatitis Society Core Allergen Series

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Evidence for the effectiveness of patch testing and the need for an expanded series that provides experience and evidence-based suggestions for an extended patch testing series are examined in this review. Many of those testing with shorter allergen series are interested in expanding the spectrum of patch testing. The American Contact Dermatitis Society (ACDS) Core Allergen Series Group has arranged a group of suggested allergen groups that can be logically scaled up or down depending on the needs of the patch tester and the community being tested. This is not an “ACDS 80 Standard.” We suggest a core group of allergens similar to the TRUE Test (SmartPractice, Phoenix, Ariz) with subsequent trays providing a greater breadth of coverage in a logical fashion, with more likely allergens being higher in the tray. For more extensive testing, specialty trays (ie, cosmetics, metals, plant, etc) are recommended.

Patch testing is the gold standard for evaluating allergic contact dermatitis and has been since its introduction by Jadassohn in 1895.^{1,2} Early evaluation and diagnosis of Allergic Contact Dermatitis are associated with decreased costs to the health care system and improved quality of life and disease course.³

The sensitivity and specificity of the patch test are estimated at 70% to 80%.^{4,5} Nethercott and Holness⁶ compared the North American Contact Dermatitis Group (NACDG) and International Contact Dermatitis Research Group series, showing a sensitivity of 77%, specificity of 71%, positive predictive value of 69%, and negative predictive value of 78% versus 68%, 77%, 66%, and 79%, respectively. The NACDG series showed a trend to being more sensitive ($P = 0.06$),⁶ possibly because of the higher number of tested allergens in the NACDG series. Only approximately 50% of positive patch tests are relevant.² Likely, these numbers are subject to the inherent pitfalls of patch testing: irritant reactions, false-positive results and dependence on the familiarity, and knowledge and skill level of the performing physician.⁴ The patch test is

reproducible with simultaneous double testing and consecutive testing at rates between 40% and 92%.^{7–10}

In the world of patch testing, using a “standard series” seems to be uniformly desirable. Unfortunately, the standard being strived for is not and probably should not be uniformly applicable and relevant across an entire country and population that are in need of patch testing. The allergen manufacturers alone offer various “standards” that are not uniform, and various patch testing groups recommend a wide variety of standard allergens. However, a larger series is likely a better screening series.¹¹

In comparisons between “standard series” with less than 30 allergens and more than 60 allergens, the shorter series was felt to completely evaluate only 28% of those tested. Twenty-three percent did not have any positives from the less than 30 allergen series, which was detected by the extended screen.¹² The Mayo Clinic data from 2000 to 2007 also showed the shorter series missing 23% of preservative, 11% of fragrance, and 17% of vehicle allergies.¹³ Another comparison looked at a 65-allergen standard and supplemental allergen trays. A mean of 86 patches was applied. Sixty-five percent were positive only to the 65-allergen screening series, and 9% were positive only to the supplemental allergens. The authors state that using supplemental allergens increased the accuracy of diagnosis by 34%.¹⁴ From the perspective of diagnostic accuracy in patch testing, the old adage is probably correct, “more is better.”

The goal of this core allergen approach is not to make an “ACDS 80 Standard.” It is the goal of the American Contact Dermatitis Society (ACDS) to provide a group of suggested allergen groups that can be logically scaled up or down depending on the needs of the patch tester and the community being tested. For more extensive testing, specialty trays (ie, cosmetics, metals, plastics/glues, plant, etc) are helpful, based on the individual’s history and exposures. Evaluating occupational sources of dermatitis frequently

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TABLE 1. ACDS Recommended Allergen Series**Core Allergen Panel I**

1. Nickel sulfate 2.5% pet*
2. Myroxylon pereirae 25% pet*
3. Fragrance mix I 8% pet*§
4. Quaternium 15 2% pet*
5. Neomycin 20% pet*
6. Budesonide 0.1% pet*
7. Formaldehyde 1% aq*§
8. Cobalt chloride 1% pet*§
9. *p-tert*-Butylphenol formaldehyde resin 1% pet*
10. *p*-Phenylenediamine 1% pet*

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 0.6% 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*

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. Hydroxymethyl 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

TABLE 1. (Continued)**Core Allergen Panel I****Core Allergen Panel VI**

51. Tea tree oil 5% pet
52. Chlorhexidine digluconate 0.5% aq
53. Chloroxyleneol (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§

Core Allergen Panel VII

61. 2-Hydroxy-4-methoxybenzophenone-5-sulfonic acid (benzophenone-4) 2% pet
62. Triclosan 2% pet
63. Sorbic acid 2% pet
64. Ylang ylang 2% pet
65. Compositae mix II 5% pet
66. Ethyleneurea melamine-formaldehyde 5% pet
67. Sorbitan sesquioleate 20% pet
68. N,N-Diphenylguanidine 1% pet
69. Cetyl steryl alcohol 20% pet
70. Glutaraldehyde 1% pet

Core Allergen Panel VIII

71. Triamcinolone 1% pet
72. Clobetasol-17-propionate 1% pet
73. DI Alpha Tocopherol 100%
74. Ethyl cyanoacrylate 10% pet
75. Phenoxyethanol 1% pet
76. Disperse Orange 3 1% pet
77. *Jasminium officinale* oil 2% pet
78. 2, 6-Ditert-butyl-4-cresol (BHT) 2% pet
79. 2-Ethylhexyl-4-methoxycinnamate 10.0 pet
80. Benzyl alcohol 10%

aq, aqueous; DMDM, 1,3-Dimethylol-5,5-dimethyl; PCMX, *p*-chloro-meta-xyleneol; DEA, diethanolamide; PCMC, *p*-chloro-meta-cresol.

*TRUE Test allergen.

†Caine mix (containing benzocaine) is the TRUE Test allergen.

‡Disperse blue 106 is the TRUE Test allergen.

§Interpret reactions with caution, mild irritant, and/or low clinical relevancy.

requires supplemental allergen trays, based on the relevant work exposures.

We have assembled a stepwise progression for a suggested core group of allergens that are helpful for complete screening for allergic contact dermatitis (Table 1). The first core groups of allergens are panels I to IV. This group of allergens is similar in composition to that of the TRUE Test allergens (SmartPractice, Phoenix, Ariz) with the assumption that this or other similar basic screening series is commonly used in everyday practice for many dermatologists or allergists. Alternately, if the patient already has been tested with the TRUE Test, starting testing at allergen number 37 may be desirable.

Subsequent panels, in groups of 10, are suggested for addition to the core 4 panels as desired, based on the needs of the physician. Panels V to VIII are sorted in decreasing likelihood of positivity based on the NACDG 2009 to 2010 data¹⁵ and arranged to minimize proximity to cross-reacting allergens. Although we do not have data to sort by relevance, our goal was to place allergens that we believe are more relevant in lower numbered panels.

There are several changes from the standard allergens on the TRUE Test. We chose to test with Amerchol L101 instead of wool alcohol because it may give a higher rate of true positives for lanolin allergy.¹⁶ Thimerosal was named the “Non-allergen of the Year” by the ACDS in 2006 because of its frequent positivity and rare relevance.¹⁷ Therefore, thimerosal was omitted from the routine screening series. Disperse blue 106, disperse blue 124, and disperse orange 3 are the most common causes of textile dye Allergic Contact Dermatitis.¹⁸ To better screen for textile allergy, we substitute disperse blue 106/124 mix for disperse blue 106 on the TRUE Test. Disperse orange 3 is included in our recommended standard on panel VIII.

As opposed to the TRUE test, dibucaine, lidocaine, and benzocaine are tested individually, not in the caine mix form. The TRUE Test caine mix contains benzocaine, dibucaine (cinchocaine), and tetracaine. Patch testing to the caine mix is superior to benzocaine alone as a single screening allergen because of missed reaction to dibucaine.¹⁹ Considering reported rates for dibucaine, benzocaine, and lidocaine of 7%, 10%, and 12%, respectively, we chose to separate the allergens for greater precision versus using a caine mix.²⁰ We chose to eliminate tetracaine.

Sensitization to gold is frequent, between 15% and 23% in a recent evaluation of reaction rates to the Mayo Clinic Standard and Metal series.²¹ Rates of relevance ranged between 24% and 54%, depending on which gold allergen was tested (ie, gold sodium thiosulfate 0.5 and 2% petrolatum, potassium dicyanoaurate 0.25% petrolatum, and gold chloride 0.5% alcohol).²¹ For those individuals without dermatitis or those lacking gold exposures, a positive patch test reaction should be considered an irrelevant sensitization. In those with long-duration exposure to gold dental restorations, the reaction may be due to oral gold exposure.²² In those individuals with facial/eyelid dermatitis and frequent gold exposure, a positive gold patch test reaction is potentially relevant, useful to the patient, and worth evaluating.²³ Therefore, we chose to include gold in this series.

Patch testing to an appropriate array of allergens is important and necessary for an accurate diagnosis or exclusion of allergic contact dermatitis. Expanded testing likely produces a more complete evaluation. The ACDS Core Allergen series hopefully will help guide clinicians in extending their screening beyond a small core group of allergens in a logical and stepwise manner and thus provide more complete answers that help solve our patient's problems with allergic contact dermatitis.

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