
Skin testing: a survey of allergists

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Background: In the allergist's office, skin testing remains the central way to confirm allergic response. Although anecdotal data suggest widely varying practices in skin testing by allergists, the diversity and relative frequency of these practices have not been documented.

Objective: To determine the extent of the diversity in skin testing practices among allergists.

Methods: A questionnaire was sent via the Internet to all physician members and fellows of the American College of Allergy, Asthma and Immunology who practice in the United States. This survey explored choice of extract concentrations, skin test device, number and type of tests, method for interpretation and documentation of skin test results, and quality assurance procedures used.

Results: Overall, a significant degree of variability was reported with regard to number of skin tests performed, extract concentrations, skin test devices, interpretation and documentation of results, and quality assurance procedures. The average number of skin prick tests performed ranged from 5.09 (grasses) to 10.9 (trees), whereas the average number of intradermal tests performed ranged from 2.03 (grasses) to 5.6 (perennial). The allergen extract concentrations used for intradermal testing varied widely. Expressed as a dilution of the concentrated extracts, 20.8% use 1:100 dilutions, 10.3% use 1:500 dilutions, and 59.4% use 1:1,000 dilutions. Significant variability also occurred regarding devices and the technique with which the devices were used. Most clinicians (92.1%) used the most concentrated extract available for skin prick testing. For reporting the results of skin testing, 53.8% used a 0 to 4+ scale, and only 28.3% measured orthogonal diameters. Of those using a 0 to 4+ scale, two thirds related the results to the size of the histamine control. Quality assurance testing was reportedly performed by 61.2% of responders. However, less than 10% of responders used an objective test protocol for this purpose.

Conclusions: This survey highlights some of the areas that allergists can improve on in the use and reporting of skin tests.

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INTRODUCTION

Allergists have learned a great deal about the science of skin testing since Dr. Blackley's first report in 1865.¹ In the allergist's office, skin testing remains the central test to confirm allergic response. This is not surprising, because it is minimally invasive and when performed correctly has good reproducibility. Skin testing has demonstrated good correlation with results of nasal challenge² and bronchial challenges (when nonspecific airway responsiveness to histamine is included).³ It is important however that the technician who performs the skin tests and the clinician who orders or interprets these test results understand variables that may affect the outcome of these tests. These variables include the type of skin test, the device used, the location on the body where tests are performed, the extracts being used, and the effects of medications that may suppress skin test response. These issues have been reviewed elsewhere in great detail.^{4–6} As important as the proper performance of skin testing is the method used for interpretation of the results. Several grading systems are currently used by the allergy community.⁷

Allergy patients may have to change their allergist for numerous reasons. Thus, it is important that prior allergy

testing records be interpretable by the receiving physician. The frequency of poor quality of transfer skin test records has led to the development of standardized forms, which would allow better communication of skin test data to new physicians.

Although anecdotal data suggest widely varying practices in skin testing by allergists, the diversity and relative frequency of these practices has not been documented. This study aimed to determine the extent of the diversity in skin testing practices among allergists.

METHODS

A questionnaire was constructed to evaluate allergists' practices regarding skin testing. This survey was sent to all physician members and fellows of the American College of Allergy, Asthma and Immunology (ACAAI) who practice in the United States. This was accomplished via an e-mail prompt to an ACAAI Web site. This questionnaire explored the choice of extract concentrations, skin test device, number and type of tests, and method for interpretation and documentation of skin test results (Fig 1).

RESULTS

Overall, a significant degree of variability was reported with regard to the number of skin tests performed, extract concentrations, skin test devices, and interpretation of results. Of 3,000 physicians invited to participate, 539 (18%) completed the survey. Ninety-two percent of respondents were board

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US Skin Testing Questionnaire

1. How many years have you been in an allergy/immunology practice?
_____ years.

2. Are you *board eligible* or *board certified* in allergy/immunology (please circle appropriate response)?

3. What region of the United States is your practice located?
- A. Northeast (MD, DE, PA, NY, NJ, CT, MA, VT, RI, NH, ME)
 - B. Southeast (AR, LA, MS, AL, GA, FL, SC, NC, VA, WV, KY, TN)
 - C. Southwest (TX, NM, AZ, OK)
 - D. Great Lakes (MN, WI, MI, IN, OH, IL)
 - E. Plains States (IA, MO, KS, NE, SD, ND)
 - F. Mountain States (MT, WY, CO, UT, NV, ID)
 - G. Pacific States (CA, OR, WA, HI, AK)

4. Do you perform prick/puncture skin testing (PST)?

- A. Yes
- B. No*

*If you have answered no, please skip to question 10.

5. If so, what do you consider a positive prick skin test (circle correct answer)?

- A. Same size as histamine
- B. 3mm greater than negative control
- C. Other (please describe) _____

6. How many PSTs do you generally perform in your standard work-up?

Do you usually customize the skin test panel for each patient, i.e. tests based on their history rather than a standard panel? Yes No

In your standard prick skin test panel, how many are:

- A. Perennial allergens (number)? _____ D. Weeds (number)? _____
- B. Trees (number)? _____ E. Molds (number)? _____
- C. Grasses (number)? _____

7. Which device do you use for performing PST (circle correct answer)?

- A. Smallpox needle
- B. DuoTip (twist technique) (prick technique)
- C. Quintest
- D. Multitest
- E. DermaPik (twist technique) (prick technique)
- F. Other _____

8. Do you use the most concentrated extract to perform PST (circle correct answer)?

- A. Yes*
- B. No

*If you have answered Yes, please skip to question 10.

9. If you answered no, what dilution of full strength/stock extract do you use?

- A. 1:1,000 C. 1:10
- B. 1:100 D. Other _____

10. Do you perform intradermal skin tests (ID)?

- A. Yes
- B. No*

* If you have answered no, please skip to question 14.

11. If so, what do you consider a positive ID test (please circle correct response)?

- A. Same size as histamine
- B. 3mm greater than negative control
- C. Other (please describe) _____

12. What dilution (s) of your stock extract concentration do you use for ID testing? (please circle correct answer/s)?

- A. 1:10,000 E. 1:100
- B. 1:5,000 F. 1:50
- C. 1:1,000 G. 1:10
- D. 1:500 H. Other _____

13. How many ID do you generally perform for your routine evaluation?

If the prick skin test is negative how many intradermal tests would you normally perform?

- A. Perennial allergens (number)? _____
- B. Trees (number)? _____
- C. Grasses (number)? _____
- D. Weeds (number)? _____
- E. Molds (number)? _____

14. How do you express skin test results (please circle correct response)?

- A. Positive or Negative
- B. Orthogonal diameter
- C. 0-4+ scale with respect to histamine
- D. 0-4+ scale without respect to histamine* _____
- E. Other _____

* Please enclose criteria for your scale

15. On your skin test results sheet, do you include (please circle correct response)?

- A. Type of testing method: Yes No
- B. Extract manufacturer: Yes No
- C. Concentration of extract for Prick skin testing: Yes No
- D. Concentration of extract for intradermal skin testing: Yes No
- E. Device used: Yes No

16. Do you perform quality assurance testing on your technicians performing skin testing? Yes No

If yes, how is this performed? _____

And how often? _____

Figure 1. Skin testing questionnaire used in the study.

certified in allergy, with an average of 7.25 years in practice (range, 1–45 years). Physicians from all 7 regions of the United States participated, with approximately 50% of respondents located in the Northeast and Southeast. Almost all allergists performed skin prick testing (98.7%), although the number of tests performed greatly varied (Table 1). There appeared to be no obvious trend among different geographic regions in the number of skin prick tests performed. The criterion for a positive skin prick test result of a wheal 3 mm greater than the negative control was used by 71.6% of responders, 13.5% considered a reaction the same size as the histamine control to be positive, whereas 14.9% used other criteria, such as a wheal 5 mm greater than the negative control. Only 46.5% of respondents said they relied on the patient's history to determine their choice of allergens for testing; the others used a standard panel for all patients. Significant variability occurred regarding devices and the technique with which the devices were used (Table 2). Most clinicians (92.1%) used the most concentrated extract available for skin prick testing.

Intradermal skin testing was used by 85.2% of the responders. The allergen extract concentrations used for intradermal testing varied widely. Expressed as a dilution of the concentrated extracts, 20.8% use 1:100 dilutions, 10.3% use 1:500 dilutions, and 59.4% use 1:1,000 dilutions. As with skin prick testing, considerable variability occurred in the number of intradermal tests performed (Table 1). Most used criteria similar to those used for skin prick testing for defining a positive reaction, with most (55.2%) considering a positive reaction one in which the wheal was 3 mm greater than the negative control. Eighteen percent considered a reaction greater than or equal to the histamine control as a positive response. Another commonly used criterion was a wheal 5 mm greater than the negative control.

For reporting the results of skin testing, 53.8% used a 0 to 4+ scale, and only 28.3% measured orthogonal diameters. Of those using a 0 to 4+ scale, two thirds related the results to the size of the histamine control.

Information provided by respondents on their skin testing forms is tabulated in Table 3. Most recorded the type of test

Table 2. Device and Technique Used for Skin Prick Testing

Device and technique	Use by physicians, %
Smallpox needle	4.1
Duotip-Test (twist technique)*	2.7
Duotip-Test (prick technique)*	12.2
Quintest†	11.8
Multitest CMI*	25.5
DermaPik (twist technique)‡	7.2
DermaPik (prick technique)‡	20.5
Other	20 (many included various forms of needles)

* Lincoln Diagnostics Inc, Decatur, IL.

† Hollister-Stier LLC, Spokane, WA.

‡ Greer Laboratories, Lenoir, NC.

being performed (86%); however, only half reported the concentration of extract being used (51% for skin prick testing and 58% for intradermal testing), 31% reported the extract manufacturer, and only 35% named the skin prick test device that was used.

Quality assurance testing was reportedly performed by 61.2% of responders. However, less than 10% of responders used an objective test protocol for this purpose.

DISCUSSION

This survey represents the largest sampling of physicians, to our knowledge, to assess the practices of allergists regarding skin testing. Although the response rate was only 18%, the raw numbers are large and thus should allow general applicability. Skin testing remains the principal tool in the determination of the presence of allergic sensitization. Reliability of skin testing and understandable documentation of test results are important when a patient is being evaluated by an allergist and when a patient changes allergists.

Data from this survey demonstrate that most allergists perform both skin prick and intradermal tests. However, a great degree of variability was seen regarding the number of tests performed, the skin prick test device and technique used in performing testing, and interpretation of test results. Most allergists do not rely on history when choosing which allergens to perform skin testing. Also, documentation regarding skin testing results is often inadequate.

Several issues deserve further comment. With regard to skin prick testing, there is a large degree of variability in the number of tests performed. This finding suggests that some

Table 1. Number of Skin Tests Performed

Test type	Average No. of tests performed (range)
Skin prick	
Perennial	8.5 (1–96)
Trees	10.9 (1–29)
Grasses	5.09 (0–20)
Weeds	8.17 (0–55)
Molds	9.84 (0–40)
Intradermal	
Perennial	5.6 (0–49)
Trees	3.34 (0–23)
Grasses	2.03 (0–11)
Weeds	2.99 (0–24)
Molds	4.37 (0–35)

Table 3. Data Recorded on Skin Test Record

Data	Yes, %	No, %
Type of testing method	86	14
Extract manufacturer	31	69
Concentration of extract		
Skin prick test	51	49
Intradermal test	58	42
Device used	35	65

Suggested Proficiency Testing/Quality Assurance Technique for Skin Prick Testing

- Using desired skin test device, perform skin testing with positive and negative controls in an alternate pattern on a subject's back (histamine 1-10 [10 mg/mL] and saline 1-10)
- Record histamine results at 8 minutes by outlining wheals with a felt-tip pen and transferring results with transparent tape to a blank sheet of paper
- Record saline results at 15 minutes by outlining wheal and flares with a felt-tip pen and transferring results with transparent tape to a blank sheet of paper
- Calculate the mean diameter $X=(D+d)/2$; D =largest diameter and d =perpendicular diameter at midpoint of D

Histamine

Calculate the mean and standard deviations of each mean wheal diameter
Determine coefficient of variation = standard deviation/mean
Quality standard should be less than 30%

Saline

All negative controls should be <3-mm wheals and <10-mm flares

Figure 2. Suggested protocol for quality assurance testing and proficiency testing for skin testing technicians.

allergists should evaluate their skin test panels to reduce the number of cross-reacting extracts that are used. Practice parameters have suggested that up to 70 skin prick tests is a reasonable number.⁸ However, most allergists perform fewer than 70 tests, suggesting that fewer tests may suffice if attention is paid to cross-allergenicity and especially if only extracts relevant for an individual patient are used for testing.

Several studies and a review using evidence-based medicine outcomes have demonstrated that the addition of intradermal testing provides no clinically useful information.⁹⁻¹¹ One could argue that in the young child with a higher threshold for a response to histamine¹² or with allergenic extracts with low potency there may be benefit in the addition of intradermal testing.

This survey demonstrated variability in the criteria used in interpreting and documenting skin test results, with only 28.2% using measurement of orthogonal diameter. In a recent study by McCann and Ownby¹³ in which allergists were asked to interpret photographic copies of skin test reactions, a great degree of variability was seen. The authors thus concluded that the most reliable method to report a skin test reaction was to measure the reaction size. Measurement of skin test diameter need not be a time-consuming procedure and has been demonstrated to correlate well with measurement of the area of the skin test reaction.¹⁴

Documentation of skin testing techniques, as expressed on skin test forms, also varied greatly. Documenting the strength of the extracts, method of skin testing, device used to perform testing, location of testing, and results of positive and negative controls represents the minimal information required to allow others to interpret the results. Additionally, the skin prick test device type and technique used deserve documentation, because studies have demonstrated clinically significant variability in reaction size based on these variables.¹⁵⁻²¹ A suggested skin test form has been developed by the Immunotherapy Committee of the American Academy of Allergy, Asthma and Immunology and is available for downloading on their Web site (www.aaaai.org).

Few allergists reported use of an objective test protocol for quality assurance. Certainly, it would be comforting to know that some degree of consistency in skin test performance is achieved by skin test technicians. Although there are no formal criteria available regarding skin test proficiency testing, several publications have provided suggested values. European publications have suggested a coefficient of variation of less than 20% following repeated skin test control applications,²² and the recent Childhood Asthma Management Plan study required a coefficient of variation of less than 30% be attained to confirm proficiency in skin testing. A suggested protocol for quality assurance testing and proficiency testing for skin testing technicians appears in Figure 2.

In 1947, Walzer wrote, "the fact that skin testing has not turned out to be a simple and completely reliable technics [sic] does not detract from the fact that when it is intelligently and skillfully performed, it remains the most effective diagnostic procedure in reaginic allergic disorders."²³ This survey highlights some of the areas that we as allergists can improve on in our use and reporting of skin tests.

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