

A comparison of skin prick tests, intradermal skin tests, and RASTs in the diagnosis of cat allergy

Robert A. Wood, MD,^a Wanda Phipatanakul, MD,^a Robert G. Hamilton, PhD,^b and Peyton A. Eggleston, MD^a Baltimore, Md

Background: Skin testing and RASTs are the most commonly used methods for the diagnosis of allergy. Questions remain, however, as to the accuracy of these tests, particularly with regard to the role of intradermal skin tests (IDSTs) in the evaluation of respiratory allergy.

Objective: The purpose of this study was to determine the predictive value of skin prick tests (SPTs), IDSTs, and RASTs in the diagnosis of cat allergy.

Methods: Patients were challenged with a well-characterized cat exposure model after evaluation by history, SPTs, IDSTs (if SPT results were negative), and RASTs. All patients were evaluated with respect to their upper respiratory responses, although only those patients with asthma were included in the analysis of lower airway responses. Challenge results were considered positive if the mean upper respiratory symptom score was 0.5 or more, the mean lower respiratory symptom score was 0.4 or more, or the maximum fall in FEV₁ value was 15% or more.

Results: One hundred twenty patients were evaluated. SPT values were positive in 81 patients; of the remaining 39 patients, IDST values were positive in 26 patients. RASTs were performed in 89 patients; the values were positive in 45 of 51 patients with a positive SPT value and were negative in all patients with a negative SPT value. When any positive challenge outcome was considered, positive challenge results were seen in 38 of 41 patients with a positive SPT score, in 10 of 39 patients with a negative SPT score, in 6 of 26 patients with a positive IDST score, in 4 of 13 patients with a negative IDST score, in 27 of 27 patients with a positive RAST score, and in 12 of 44 patients with a negative RAST score.

Conclusion: Although both SPT and RAST values exhibited excellent efficiency in the diagnosis of cat allergy, IDST scores added little to the diagnostic evaluation. (*J Allergy Clin Immunol* 1999;103:773-9.)

Key words: Skin tests, radioallergosorbent testing, cat allergy

Immediate type skin testing and RASTs are the most commonly used methods in the diagnosis of allergy. A variety of skin test methods are available, but overall they can be categorized as either percutaneous or intracuta-

Abbreviations used

BAU:	Biologic allergen units
BU:	Breath units
IDST:	Intradermal skin test
LRSx:	Lower respiratory symptom score
NPV:	Negative predictive value
PPV:	Positive predictive value
SPT:	Skin prick test
URSx:	Upper respiratory symptom score

neous. It is standard practice to begin with a percutaneous test, primarily for reasons of safety.^{1,2} It is then a common clinical practice to follow negative percutaneous test results with intradermal skin tests (IDSTs). Although this approach increases the sensitivity of skin testing, several studies have indicated that a positive IDST result is not necessarily indicative of clinical allergy.³⁻⁵ This approach to testing may therefore result in increased costs, unnecessary risk, needless discomfort, and inappropriate prescriptions for immunotherapy.

In this study, we examined the utility of skin prick tests (SPTs), IDSTs, and RASTs in the diagnosis of cat allergy. With any study of this nature, the greatest difficulty comes in accurately establishing the diagnosis of clinically significant allergy. This problem has been most easily overcome in the diagnosis of food and stinging insect allergy, for which reliable challenge methods were developed. The development of similarly accurate methods for clarifying the diagnosis of respiratory allergies has been much more difficult. In this study, the diagnosis of cat allergy has been based on our well-characterized cat challenge model, which has the advantage of exposing both the upper and lower airways to high levels of naturally generated cat allergen.⁶⁻⁸

METHODS

Subjects

Subjects between the ages of 18 and 65 years were recruited 1 of 2 ways. First, subjects who believed that they had cat allergy were recruited by advertisement. Their symptoms with cat exposure included asthma, rhinitis, or both. They were invited to participate in the study whether or not they had a positive SPT reaction to cat allergen. Second, subjects with asthma and a negative SPT reaction to cat allergen were recruited from the allergy clinic to undergo intradermal skin testing and a cat challenge. They may or may not have had a history of symptoms with cat exposure. The study was approved by the Joint Commission on Clinical Investigation of the

From ^athe Department of Pediatrics, Division of Allergy and Immunology, and ^bthe Department of Medicine, Division of Allergy and Immunology, The Johns Hopkins University School of Medicine, Baltimore.

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Reprint requests: Robert A. Wood, MD, CMSC 1102, Johns Hopkins Hospital, 600 North Wolfe St, Baltimore, MD 21287.

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Johns Hopkins University School of Medicine; all subjects gave informed consent.

Subjects were initially evaluated by a questionnaire regarding their medical history, their history of asthma or allergic rhinitis, including symptoms with cat exposure, and current medications. After a physical examination, subjects underwent SPTs with a bifurcated needle (Allergy Labs of Ohio, Columbus, Ohio) for dust mite, cat, dog, cockroach, molds (2 mold mixes, including *Aspergillus*, *Penicillium*, *Mucor*, *Fusarium*, *Alternaria*, *Helminthosporium*, *Horodendrum*, and *Botrytis* spp), and grass (orchard), tree (oak and maple), and ragweed pollens. Standardized extracts were used for testing to dust mite, cat, grass, tree, and ragweed. All subjects avoided short-acting antihistamines for 72 hours, long-acting antihistamines (loratidine, cetirizine, fexofenadine, and hydroxyzine) for 7 days, and tricyclic antidepressants for 6 weeks before skin testing.

For cat allergen, a standardized cat hair extract containing 10,000 biologic allergen units (BAU)/mL (Miles Pharmaceutical Division, Elkhart, Ind) was used for all skin testing. The freeze-dried extract was reconstituted in 50% glycerin for SPTs. For subjects with a negative SPT score, IDSTs were performed by injecting 0.02 mL into the forearm with a 27-gauge hypodermic needle. Concentrations (100 BAU/mL and 1000 BAU/mL) of the same extract that were used for SPTs were used for IDSTs. Dilutions were made with phenol-saline solution containing 0.03% human serum albumin. Control tests for SPTs were performed with 50% glycerin and histamine phosphate containing 1.8 mg/mL histamine base. Control tests for IDSTs were 0.03% human serum albumin phenol-saline solution and histamine phosphate 0.0018 mg/mL. Fresh extract dilutions were prepared weekly for IDSTs. A positive SPT result was defined as a wheal greater than or equal to one half of the diameter of the histamine control and at least 3 mm larger than the diameter of the negative control. A positive IDST result was defined as a wheal of 6 mm or larger with definite erythema.

RASTs were performed in all subjects with a negative SPT score and in most subjects with a positive SPT finding. The Phadezyme RAST (Pharmacia/Upjohn Diagnostics, Uppsala, Sweden) was used initially, and the Pharmacia CAP-RAST was used later in the study. RAST results were considered positive if they were more than 0.35 KIUa/L. All negative Phadezyme RASTs were reanalyzed with the Pharmacia CAP system (RAST FEIA), and in each instance the negative result was confirmed.

Finally, all subjects underwent spirometry (Model DECpc spirometer; Warren Collins Inc, Braintree, Mass) and a methacholine challenge test with previously described methods.⁹ The methacholine challenge finding was considered positive if the predicted dose inducing a 20% fall in FEV₁ was less than 80 breath units (BU).

Cat challenge procedure

All the subjects underwent a cat exposure challenge as previously described.⁶ In brief, challenges were performed in a 13.7-m³ room that contained 2 cats, a bed, and a small carpet. Medications were restricted before the challenges as follows: antihistamines (short-acting, 72 hours; long-acting, 7 days), inhaled β -adrenergic agonists (4 hours), salmeterol (24 hours), leukotriene antagonists (24 hours), theophylline (12 hours), nasal or inhaled cromolyn sodium (48 hours), and nasal or inhaled corticosteroids (72 hours). Before the challenge, the cats were placed in a cage, and bedding was shaken to disturb allergen. After baseline symptoms scores and spirometry were performed, the subject entered the cat room for a 1-hour exposure. During the challenge, upper respiratory symptoms (congestion, rhinorrhea, and pruritis) and lower respiratory symptoms (tightness, wheezing) were scored by the subject on an arbitrary scale of 0 to 3 every 5 minutes, and coughs and sneezes were counted. Repeat spirometry was performed every 15 minutes. Chal-

lenges were terminated early if the subject became too uncomfortable or had a drop in FEV₁ of greater than 50%. Airborne Fel d 1 was collected during each challenge with a personal air sampler (Gilian Instrument Corporation, Wayne, NJ), and levels were quantified by immunoassay as previously described.¹⁰

To calculate symptom scores, each symptom was rated on a scale of 0 to 3, and these scores were averaged to provide upper and lower symptom scores at each 5-minute time point. Those scores were then averaged to provide mean symptom scores for each 15-minute interval and for the entire challenge. Challenge results were considered positive if the mean upper respiratory symptom score (URSx) was 0.5 or more, if the mean lower respiratory symptom score (LRSx) was 0.4 or more, or if the maximum fall in FEV₁ was 15% or more.

Statistical analysis

For each test, the sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and efficiency, with their 95% confidence limits, were determined with regard to upper respiratory symptoms, lower respiratory symptoms, change in FEV₁, and any positive challenge outcome (ie, 1 or more of the 3 results were positive). Formulas used for these calculations were as follows¹¹: sensitivity = (true positive results $\times$ 100)/(true positive + false negative results); specificity = (true negative results $\times$ 100)/(true negative + false positive results); PPV = (true positive results $\times$ 100)/(true positive + false positive results); NPV = (true negative results $\times$ 100)/(true negative + false negative results); efficiency = [(true positive + true negative results) $\times$ 100]/(true positive + true negative + false positive + false negative results).

Challenge responses were compared in subjects with positive and negative SPT, IDST, and RAST results with the Mann-Whitney *U* test. A *P* value of less than .05 was considered statistically significant. All subjects were included in the analysis of URSxs; although for lower respiratory symptoms and FEV₁ changes, only subjects with a history of asthma and methacholine reactivity were included.

RESULTS

Subject characteristics

A total of 120 subjects participated in this study. Eighty-one subjects had a positive SPT finding to cat. This group included 59 women and 22 men, with the ages ranging from 20 to 59 years (mean, 32 years). All subjects had a history of symptoms with cat exposure, with 79 subjects reporting rhinitis symptoms and 44 subjects reporting asthma symptoms. Cat wheal sizes ranged from 3 to 15.5 mm, with a mean of 5.6 mm. Phadezyme RAST tests were performed in 51 subjects of this group, and the results were positive in 45 subjects, with a range of 0.8 to 54.4 RAST units (mean, 8.6 RAST units). Forty-one of the 81 subjects in this group had methacholine reactivity, with a range of 0.9 to 70 BU (mean, 25.1 BU); 72 subjects had a positive SPT result to 1 or more of the other allergens tested.

Thirty-nine subjects had a negative SPT response to cat. This group included 26 women and 13 men, with ages ranging from 18 to 66 years (mean, 34.5 years). Fifteen of these subjects were recruited by advertisement, and 24 of these subjects were recruited from the clinic. All subjects in this group had a history of asthma and a positive methacholine challenge finding (range, 0.3 to 78

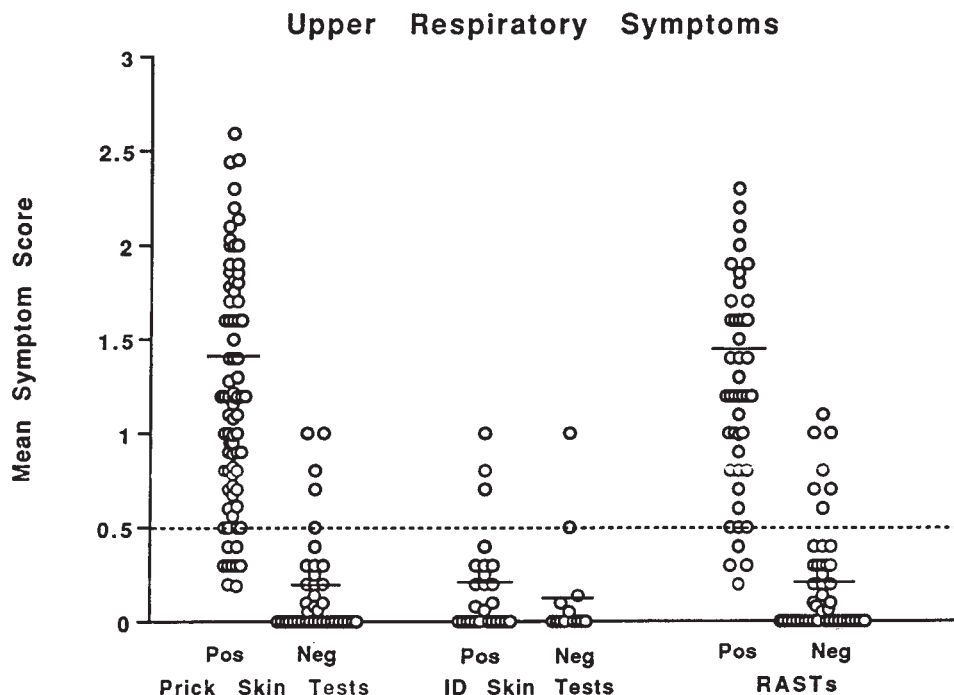


FIG 1. Mean URSxs are displayed relative to test results. A mean symptom score of 0.5 or more (dashed line) was considered positive. Group mean values are designated by the solid lines. *P* values comparing positive and negative test scores were less than .0001 for SPTs, .35 for IDSTs, and less than .0001 for RASTs. *Pos*, Positive; *Neg*, negative.

BU; mean, 29.3 BU); 35 of the 39 subjects had a history of allergic or nonallergic rhinitis. IDST results were positive at 100 BAU/mL in 13 subjects and at 1000 BAU/mL in 26 subjects. Wheal sizes in the IDST-positive subjects at 1000 BAU/mL ranged from 6.5 to 12.5 mm, with a mean wheal size of 8.3 mm. All 39 subjects with a negative SPT score had negative RAST scores, 20 of which were performed by the Phadezyme system and all of which were analyzed by the CAP system. A history of cat-induced symptoms was reported in 12 of 26 subjects with a positive IDST finding and in 7 of 13 subjects with a negative IDST finding. Thirty of the 39 subjects had a positive SPT result to 1 or more other allergens tested.

Cat challenge results

URSxs are displayed in Fig 1. Seventy-three of the 81 subjects with a positive SPT finding were judged to have a positive upper respiratory response (mean URSx range, 0.19 to 2.6; mean, 1.22). In the 39 subjects with a negative SPT response, mean URSx ranged from 0 to 1.0 (mean, 0.17), with 5 subjects having a positive URSx response. Upper respiratory responses in subjects with a positive and negative SPT response were significantly different ($P < .0001$). When the 39 subjects with a negative SPT response were divided into those with a positive or negative IDST finding, no differences in upper respiratory responses were detected ($P = .35$). URSxs ranged from 0 to 1.0 (mean, 0.2 [positive in 3 of 26 subjects]) in subjects with a positive IDST finding and from 0 to 1.0

(mean, 0.12 [positive in 2 of 13 subjects]) in those subjects with a negative IDST finding. Finally, 41 of the 45 subjects with a positive RAST finding had a positive upper respiratory response (URSx range, 0.2 to 2.3; mean, 1.26). These responses were significantly different from those with a negative RAST finding ($P < .0001$), in whom positive responses occurred in 6 of 45 subjects (URSx range, 0 to 1.1; mean, 0.18).

LRSxs and FEV₁ changes were analyzed only in the 80 subjects with a history of asthma and a positive methacholine challenge result. Positive LRSxs were seen in 36 of 41 subjects with a positive SPT finding (LRSx range, 0 to 2.67; mean, 1.11), compared with 7 of 39 subjects with a negative SPT finding (LRSx range, 0 to 1.2; mean, 0.16; $P < .0001$; Fig 2). Subjects with a negative SPT finding had similar LRSx responses whether or not they had a positive IDST finding. Positive LRSxs occurred in 4 of 26 subjects with a positive IDST finding (range, 0 to 1.2; mean, 0.18), compared with 3 of 13 subjects with a negative IDST finding (range, 0 to 0.7; mean, 0.14; $P = .89$). Twenty-five of 27 subjects with a positive RAST finding had a positive LRSx (range, 0.2 to 2.1; mean, 1.11), compared with 8 of 45 subjects with negative RAST findings (range, 0 to 1.2; mean, 0.17; $P < .0001$).

FEV₁ changes of 15% or greater occurred in 32 of 41 subjects with a positive SPT finding (range, 1% to 72%; mean, 31.2%), compared with only 1 of 39 subjects with a negative SPT finding (range, 0% to 26%; mean, 5.2%;

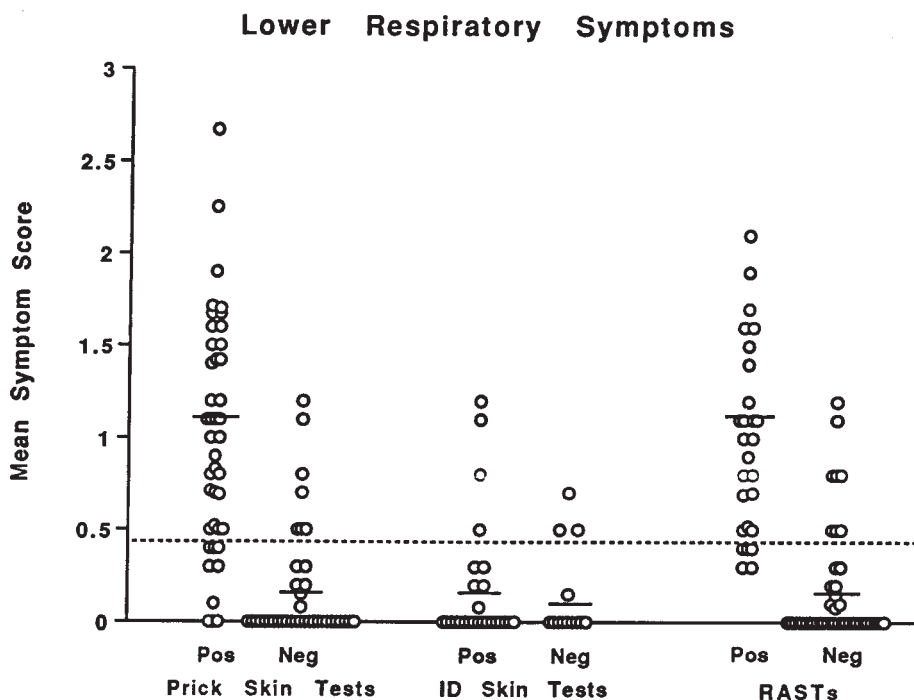


FIG 2. Mean LRSxs are displayed relative to test results. A mean symptom score of 0.4 or more (dashed line) was considered positive. Group mean values are designated by the solid lines. *P* values comparing positive and negative test scores were less than .0001 for SPTs, .89 for IDSTs, and less than .0001 for RASTs. Pos, Positive; Neg, negative.

$P < .0001$; Fig 3). None of the 26 subjects with a negative SPT finding, but positive IDST finding, had a positive FEV₁ response (range, 0% to 14%; mean, 5.1%), although 1 of 13 subjects with a negative IDST finding had a greater than 15% fall in FEV₁ value (range, 0% to 26%; mean, 5.5%; $P = .63$). Positive FEV₁ responses occurred in 20 of 27 subjects with a positive RAST finding (range, 1% to 52%; mean, 27.8%), compared with 2 of 45 subjects with negative RAST findings (range, 0% to 26%; mean, 5.1%; $P < .0001$).

The challenge results were also analyzed to include any positive challenge outcome, again limited to those subjects with a history of asthma and a positive methacholine challenge result (Table I). This analysis revealed that 38 of 41 subjects with a positive SPT finding had a positive challenge result, compared with 10 of 39 with a negative SPT finding ($P < .0001$). Six of 26 subjects with a negative SPT, but positive IDST, finding had a positive challenge result, although 4 of 13 subjects with a negative IDST had a positive challenge result ($P = .54$). Positive challenge results occurred in 27 of 27 subjects with a positive RAST finding, compared with 12 of 44 subjects with a negative RAST finding ($P < .001$).

Some subjects were unable to complete the full 60-minute challenge because of excessive discomfort or a decline in FEV₁ of 50% or more. This occurred in 21 of 81 subjects with a positive SPT response, 0 of 39 subjects with a negative SPT response, 0 of 26 subjects with a positive IDST response, 0 of 13 subjects with a negative

IDST response, 12 of 45 subjects with a positive RAST score, and 0 of 45 subjects with a negative RAST score. All such subjects had a positive challenge result based 1 or more other criteria.

Finally, the data were analyzed to determine whether the size of the IDST response was related to challenge outcome or whether subjects with a positive IDST score at the 100 BAU/mL concentration responded differently than those subjects who had a positive IDST score only at the 1000 BAU/mL concentration. No relationship between skin test size and challenge outcome was detected. For example, when the 10 subjects with a IDST wheal of 6 mm or more were evaluated separately, only 3 subjects had a positive challenge result. Similarly, no differences were noted between those subjects with a positive IDST score at 100 versus 1000 BAU/mL, with positive challenge results occurring in 3 of 13 subjects with a positive IDST result at 100 BAU/mL and in 7 of 26 subjects with a positive IDST result at 1000 BAU/mL.

On the basis of these challenge results, the sensitivity, specificity, PPVs, NPVs, and efficiency were calculated for each test (Table II). SPTs demonstrated high levels of sensitivity (range, 79% to 97%), specificity (80% to 91%), PPV (79% to 93%), NPV (74% to 97%), and overall efficiency (85% to 89%). Results for IDSTs were overall less favorable (sensitivity range, 0% to 60%; specificity, 31% to 32%; PPV, 0% to 23%; NPV, 77% to 92%; and efficiency, 31% to 39%); RAST results were similar to those for SPTs (sensitivity range, 69% to 91%;

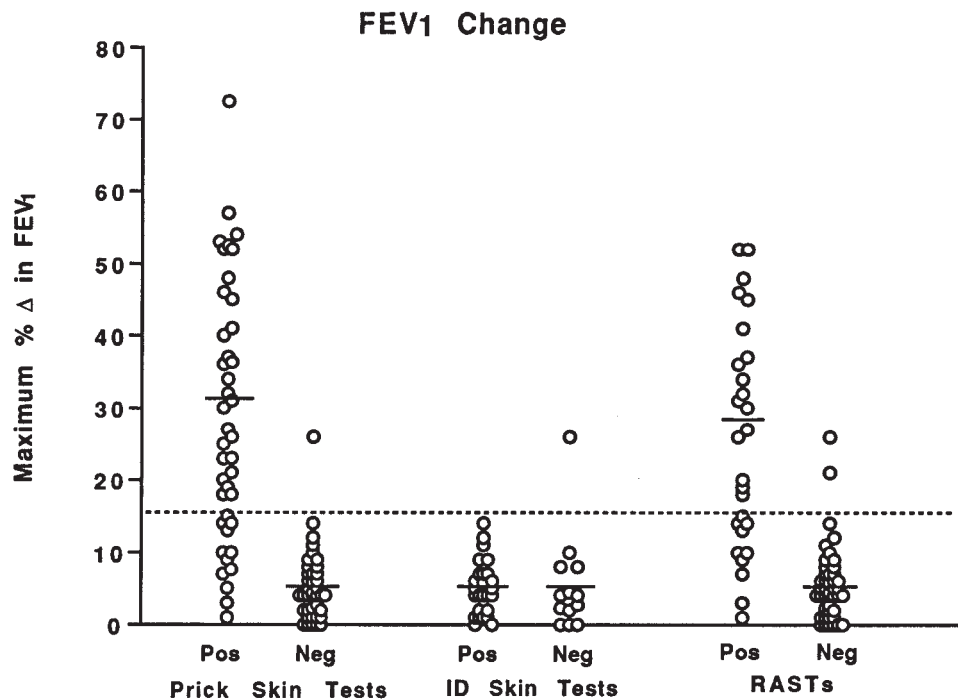


FIG 3. Maximum changes in FEV₁ values are displayed relative to test results. A maximum fall of 15% or more (dashed line) was considered positive. Group mean values are designated by the solid lines. *P* values comparing positive and negative test results were less than .0001 for SPTs, .63 for IDSTs, and less than .0001 for RASTs. *Pos*, Positive; *Neg*, negative.

TABLE I. Challenge outcome versus test results

Challenge outcome	SPTs		IDSTs		RASTs	
	Positive	Negative	Positive	Negative	Positive	Negative
Positive	38	10	6	4	27	12
Negative	3	29	20	9	0	32

A positive challenge result indicates a positive result for 1 or more of the 3 outcome measures (URSx, LRSx, and FEV₁).

specificity, 84% to 100%; PPV, 74% to 100%; NPV, 73% to 95%; and efficiency, 83% to 89%).

DISCUSSION

In this study, we compared the analytical performance of the SPTs, IDSTs, and RASTs in the diagnosis of cat allergy. Although SPTs and RASTs exhibited high levels of sensitivity, specificity, PPVs, NPVs, and overall efficiency, IDSTs performed considerably less well. In fact, once a subject was found to have a negative SPT score, they were just as likely to have a positive challenge result if they had a negative IDST score (31%) as when they had a positive IDST result (24%). Although IDSTs did have reasonable NPVs, they were actually no more accurate than SPTs in that regard either. IDSTs may therefore have value in ruling out a clinically relevant cat sensitivity; but because of their poor sensitivity, specificity, and positive predictive efficiency, they should be used with caution for other purposes. At least with regard to cat

allergy, these results strongly suggest that major therapeutic decisions, such as environmental control or immunotherapy, should never be based on a positive IDST result alone.

The utility of IDSTs clearly varies in different clinical situations. For penicillin allergy and insect venom allergy, SPTs and RASTs may not be sufficiently sensitive, leading to potential false-negative results if IDSTs are not used.^{2,12,13} Testing in these situations is also unique in that a false-negative result can have life-threatening consequences. Alternatively, in the case of food allergy, IDSTs are rarely, if ever, appropriate.¹⁴ In this situation, SPTs and RASTs are already too sensitive, with very few false-negative results and a high frequency of false-positive results.

The role of IDSTs in the evaluation of respiratory allergy is considerably less clear. Nelson et al³ showed that in the diagnosis of grass pollen allergy, a positive IDST result in the presence of a negative SPT is not indicative of clinically significant sensitivity. They used

TABLE II. Predictive value of skin tests and RASTS

	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Efficiency (%)
PST					
URSx	93.6 (±4.3)	80.1 (±7.1)	90.1 (±5.3)	87.1 (±6.0)	89.2 (±5.6)
LRSx	83.7 (±8.1)	86.5 (±7.5)	87.8 (±8.6)	82.1 (±8.4)	85.0 (±7.8)
FEV ₁	96.9 (±3.8)	80.9 (±8.6)	78.5 (±9.0)	97.4 (±3.5)	87.5 (±7.2)
Any	79.2 (±8.9)	90.6 (±6.4)	92.6 (±5.7)	74.3 (±9.6)	83.4 (±8.2)
IDST					
URSx	60 (±15.3)	32.3 (±14.7)	12 (±10.2)	84.6 (±11.3)	36.8 (±15.1)
LRSx	57.1 (±15.5)	31.2 (±14.5)	15.3 (±11.3)	76.9 (±13.2)	35.8 (±15.0)
FEV ₁	0	31.6 (±14.6)	0	92.3 (±8.4)	30.8 (±14.5)
Any	60.0 (±15.3)	31.0 (±14.5)	23.1 (±13.2)	69.2 (±14.5)	38.5 (±15.3)
RAST					
URSx	87.2 (±6.9)	90.5 (±6.1)	91.1 (±5.9)	86.4 (±7.1)	88.8 (±6.6)
LRSx	75.8 (±9.7)	94.9 (±5.0)	92.6 (±5.8)	81.6 (±8.8)	84.8 (±8.2)
FEV ₁	90.9 (±6.6)	84.1 (±8.3)	74.1 (±9.9)	94.9 (±5.0)	86.4 (±7.1)
Any	69.2 (±10.5)	100	100	72.7 (±10.1)	83.1 (±8.5)

95% Confidence limits are indicated in parentheses.

both nasal challenges and symptom scores during the grass pollen season to establish the diagnosis of a clinical grass allergy. Depending on the criteria used, the probability of a subject with a negative SPT and positive IDST result having a true grass allergy ranged from 0% to 33%, even though all the subjects in this group had a positive history for grass pollen sensitivity.

Reddy et al⁴ studied IDSTs in the evaluation of patients with symptoms of perennial rhinitis. They compared skin test results to RASTs, nasal provocation tests, and leukocyte histamine release and found that patients with a positive SPT result also had positive results with the other test methods 63%, 89%, and 89% of the time, respectively. However, in 34 patients with negative SPTs, but positive IDST results, all patients had negative RAST and leukocyte histamine release results, and only 1 patient had a positive nasal challenge result. Finally, in a large epidemiologic study from Tucson, Ariz, results of SPTs and IDSTs were compared with the subjects' histories of allergic disease. They found that in the presence of a negative SPT finding, a positive IDST reaction to the same allergen was seen more often in asymptomatic subjects than in symptomatic subjects.⁵

These studies, each looking at different allergens with different methods, provide strikingly similar results. Each suggests that IDSTs add little, or possibly even nothing, to the use of carefully performed SPTs. However, before this hypothesis can be conclusively established, 2 important issues must be addressed. First, an appropriate gold standard for the diagnosis of respiratory allergy needs to be defined; second, this conclusion needs to be examined in the context of different allergen extracts and test methods.

The issue of a gold standard for diagnosis has been most clearly defined for food and stinging insect allergy. In these conditions, challenge methods have been developed that provide virtually irrefutable results, thereby allowing for an accurate assessment of other diagnostic methods. For respiratory allergy, however, no such gold

standard exists. Patient histories, symptom diaries during pollen seasons, and nasal provocation tests have been used in previous studies; although each method can provide useful information, all methods have significant limitations. In this study, we used our well-characterized cat challenge model, which has been shown to correlate well with both nasal and bronchial provocation challenges.⁷ It is particularly useful because it allows for the exposure of both the upper and lower airways to naturally generated cat allergen. The allergen exposure is intense, and symptoms are rapidly elicited in most subjects who are allergic to cat. To maximize consistency, we chose to evaluate lower respiratory symptoms and pulmonary function changes in subjects with both a history of asthma and a positive methacholine challenge result.

However, although this challenge model may well be the best that is available for cat or other inhalant allergens, it still has inherent limitations and may therefore not be a true gold standard. The cat room is an environment with strong odors and high airborne particulate levels that will certainly induce occasional false-positive challenge results, especially in subjects with significant airway reactivity. This possibility was most clearly demonstrated by the subject who was not allergic to cat but who had a 26% decline in FEV₁ value. Alternatively, other patients might have a negative cat challenge but still experience symptoms after living with a cat for a few weeks. In addition, although we chose positive thresholds for symptom scores for positive and negative challenge results based on extensive data from over 400 previous challenges, they are nonetheless arbitrary. However, when the only truly objective outcome measure, FEV₁, was specifically examined, the results are the most compelling. Whereas a fall in FEV₁ of 15% or more occurred in 32 of 41 subjects with a positive SPT result, only 1 subject with a negative SPT result had a similar fall in FEV₁ and that person had a negative IDST result.

The second issue has to do with the nature of allergen extracts and possible variations in test methods. Both our

study and that of Nelson et al³ used potent, standardized extracts for testing. It is possible that SPTs would not perform as well if less potent extracts were used and that IDSTs might still be valuable in certain situations. This stresses the need to use the most potent extracts available and thoughtful clinical judgment in determining the potential value of IDSTs in some situations. In addition, test methods used in the application of SPTs can vary, and it is imperative that the clinician select a method that has been adequately tested and standardized.^{2,15} With these issues in mind, it can still be concluded that in the usual clinical situation, with potent allergen extracts and appropriate test methods, SPTs should be the mainstay of diagnosis and positive IDST results should be interpreted with care.

We have also shown that the detection of IgE antibody in the blood by RAST is highly effective in the diagnosis of cat allergy. The RAST displayed excellent sensitivity, specificity, PPVs, and NPVs. All subjects with a positive RAST score had at least 1 positive challenge outcome, compared with 12 of 44 subjects with a negative RAST score. In addition, no subject with a negative SPT score, including those with a positive IDST result, had a positive RAST result. These results indicate that RAST scores are highly specific but somewhat less sensitive than SPT scores, at least when a potent extract is used for skin testing, although it is possible that the sensitivity would have been improved had we used the CAP-RAST system for all subjects. These data are overall consistent with previous studies,^{4,16,17} although in a pediatric study by Ownby and Bailey,¹⁸ skin tests were only found to be more sensitive than RASTs when compared with IDSTs.

In conclusion, this study clearly supports the value of SPTs and RASTs in the diagnosis of cat allergy. Although not perfect, a positive result with these 2 tests is most often indicative of a true cat allergy; a negative result, especially for SPTs, rules out most cases of cat allergy. IDSTs appear considerably less diagnostically useful. Although a negative result is certainly consistent with a low likelihood of clinical reactivity, it is only slightly more meaningful than a negative SPT result, and a positive result appears to bear little or no clinical significance. Even though the conclusions from this study can only be applied for cat allergy, they are likely to be true whenever sufficiently potent extracts are available for testing. When taken in combination with other stud-

ies that have reached similar conclusions, we would suggest that the routine use of IDSTs in the evaluation of respiratory allergy be an exception rather than the rule.

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