

PILOT STUDY

Autonomic Response Testing Compared With Immunoglobulin E Allergy Panel Test Results: Preliminary Report

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ABSTRACT

Context • Chronically ill patients who have failed standard medical assessment and therapies are often assessed by integrative medical providers for atypical manifestations of allergies as the possible source or contributing factor(s) to their condition. Skin testing and immunoglobulin E (IgE) allergy panels increase the cost of care in these patients.

Objective • The objective of this study was to determine the accuracy of autonomic response testing (ART) as compared with IgE allergy panel blood tests.

Design • This study was a retrospective chart review of patients who had ART and blood drawn for an IgE allergy panel at the same office visit.

Outcome Measures • Sensitivity, specificity, positive predictive value, negative predictive value, overall accuracy, phi coefficient, and Cohen's kappa were calculated.

Results • A total of 14 charts were reviewed. All measures of accuracy were of either useful or excellent strength. The strength of association measures of the phi coefficient and Cohen's kappa were strong.

Conclusion • This first and preliminary evaluation of the allergy assessment utility of ART is very promising and reveals the need for more vigorous follow-up studies. (*Altern Ther Health Med.* [E-pub ahead of print.]

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An accurate low-tech in-office assessment of the presence of allergies can benefit patients in their care and reduce the cost of health care. Skin testing is considered the gold standard. Blood tests are used in cases of possible medication interference of test results, very sensitive skin, serious skin conditions, and previous reaction to an allergen suggesting a high sensitivity.¹ Both skin testing with concomitant specialist consultation and blood tests increase the cost of care. The authors' objective was to explore the accuracy of an in-office assessment method termed *autonomic response testing* (ART) compared with immunoglobulin E (IgE) blood tests. A literature search of PubMed (which includes MEDLINE), CINAHL, AMED, and EMBASE revealed no prior evaluation of ART compared with IgE allergy blood testing. In 1999, Schmitt and Leisman² studied the Goodheart version of applied kinesiology with application to identification of food allergies. However, no studies of the ART version of applied kinesiology to allergy identification have been reported until now.

Allergy Testing in the Context of Integrative Medicine

Patients often present to integrative medicine practices with chronic conditions that have been refractory to standard medical therapy. A number of integrative medicine

practitioners consider allergies with atypical presentations as part of the differential diagnosis. Thus, patients with fatigue, weight gain, muscle ache, joint pain, headache, abdominal pain, heartburn, insomnia, depression, anxiety, alopecia areata, vaginitis, dysuria, urinary urgency, and others may be assessed for the presence of an allergy.³⁻²⁵ Galland³ discussed atypical presentations of allergy in detail along with hundreds of literature citations in a recent book. Classically allergic symptoms are related to the upper or lower respiratory system and the skin. Referring a chronic fatigue patient to an allergist for skin testing is costly and impractical. Allergists in general would be reluctant to skin test someone without the typical respiratory or allergic skin manifestations such as rhinitis, sinusitis, asthma, hives, or eczema. Allergy blood tests are less costly than full allergist consultation with skin testing. However, blood testing is still expensive and often not covered by insurance. A number of integrative medicine practitioners have incorporated some form of specialized manual muscle testing often called *applied kinesiology* to assess allergies.

Autonomic Response Testing

ART is a version of applied kinesiology. Applied kinesiology was originally developed by George Goodheart, Jr, DC.^{26,27} Today, many forms of applied kinesiology are used clinically. Different originators of applied kinesiology methods believe that their method is an improvement upon others. Many integrative physicians and chiropractors use some form of applied kinesiology. The type practiced in the authors' center, known as ART, was developed by Dietrich Klinghardt, MD, PhD, and Louisa Williams, DC, ND.²⁸ Different forms of applied kinesiology can give results which conflict with the results obtained with other forms. Klinghardt²⁹ demonstrated this situation in a video on his Web site.

In manual muscle testing an assessment of muscle function is made and recorded. Applied kinesiology expands manual muscle testing assessment to a second muscle function assessment that occurs in the presence of a stimulus such as a food, toxin, allergen, etc. The 2 assessments are compared, determining whether the response to the additional stimulus was weakening, no change, or strengthening of the muscle function. Schmitt and Yanuck³⁰ have discussed the physiology of the response. The interpretation of the muscular response informs the assessment of the patient and makes a prediction of positive, negative, or neutral responses to therapies. Different forms of applied kinesiology vary in the muscles tested, the interpretation of a weak muscle response, the type and number of preparatory steps, and the manner of presentation of specific stimuli. Thus, different forms of applied kinesiology can give different results.²⁹

A systematic review by Hall et al³¹ was unable to draw clear conclusions and recommended studying applied kinesiology using a pragmatic study design. Schwartz et al³² published a negative experimental study; however, no distinction was made regarding the various forms of applied

kinesiology. No designation was given as to which form of applied kinesiology was being tested. It was implied that the form studied generalized to all versions of applied kinesiology. The article did state that the utilized protocol was not the approved Goodheart version^{26,27} of applied kinesiology.

The concluding statement appeared to lump all versions of applied kinesiology together. It is clear that neither ART^{28,29} nor the official Goodheart protocol^{26,27} was tested in the Schwartz et al³² study. Just as antibiotics and diagnostic tests can differ one from another, so can different forms of applied kinesiology differ one from another. There are no published studies that have evaluated the reliability and validity of ART. We hope this case series will prompt such studies. Our clinical experience with ART as an assessment tool has been very positive.³³⁻³⁸

METHODS

Study Design

A consecutive retrospective chart review was constructed, consisting of deidentified office notes and IgE allergy panel test results. The study was considered exempt by the University of Pennsylvania Institutional Review Board.

Subjects

Subjects were seen at 2 offices in the eastern United States. All new patients during the fall of 2015 who had an ART assessment and blood drawn for an IgE allergy panel on the same day were included in the chart review. A total of 14 charts were identified as eligible for review. All patients were chronically ill and had found no resolution of their problems from standard medical assessment and treatment. Their presenting complaints varied. Their chief complaint often did not involve the respiratory system or the skin as is typical of the usual patient who undergoes allergy testing.

The review of the 14 charts indicated an age range of 1 to 56 years; a mean age of 38.27 years; 9 males; 5 females; 9 different chief complaints; 1 chief complaint of allergic rhinitis; and 2 cases of eczema. There were no chief complaints of asthma (Table 1).

Table 1. Patient Characteristics (N = 14)

Age (y)	Range: 1 to 56 Mean: 38.27 14 y or younger: 8
Sex	9 male
Chief Complaint	
Abdominal Pain	2 patients
Allergic Rhinitis	1 patient
Anxiety	1 patient
Eczema	2 patients
Fatigue	4 patients
Flatulence and Bloating	1 patient
Headache	1 patient
Nausea	1 patient
Psoriasis	1 patient

Test Methods

The index test was ART. The multistep ART protocol is detailed in a video.³⁹ The reference test was an IgE allergy panel done by LabCorp (Burlington, NC, USA) for 13 of the 14 patients. The IgE allergy panel for patient 9 was performed by Quest Diagnostic Laboratories (Secaucus, NJ, USA). The IgE allergy panel was chosen as opposed to skin testing because of the clinical context, the financial cost, and convenience to the patient. In addition, IgE blood tests are acceptable to the American College of Asthma, Allergy and Immunology when skin testing is contraindicated.¹ The test outcomes for both the index test and the reference test were binary: positive, negative. The ART certified performer (Autumn Frandsen, ND) of the index test was also the person who performed the clinical history and physical. The number of allergens included in the blood IgE panel exceeded the number of allergens tested by ART as each blood test panel has a set number of allergen tests performed and reported. A total of 51 different allergens were tested by ART and compared to the results obtained by IgE blood testing (Table 2). The number of comparisons of ART to IgE levels varied per patient based on insurance coverage and time considerations. Clinical information was not available to the assessors of the reference standard. In all instances blood was drawn on the same day that ART was performed; thus, the test performer was not aware of the results at the time of performing ART.

Analysis

The accuracy measures of sensitivity, specificity, positive predictive value, negative predictive value, and overall accuracy (true positives plus true negatives over total number of outcomes) were performed. In addition, 2 strength of association measures were calculated: phi coefficient, and kappa statistic. Calculated for all measures were 95% confidence intervals (CIs). The Pearson's χ^2 statistical test of independence was calculated along with the corresponding *P* value. For the χ^2 test, the authors employed a level of statistical significance set at $\alpha = .05$, recognizing that tests of statistical significance are approximations that serve as aids to interpretation and inference. The aforementioned statistics with 95% CIs, both exact and bootstrapped with 1000 replications, were calculated using R, version 3.2.4 for Mac (R Project for Statistical Computing, Vienna, Austria). Bootstrapped calculated CIs were calculated because the number of comparisons of ART versus IgE varied among the patients. The bootstrap calculations were done to remediate any possible effects due to clustering.

RESULTS

There were 259 comparisons of the index test ART with the results of the reference test of blood IgE levels. Within the cohort, 51 different allergens were tested. The number of allergens tested varied per patient with a range of 8 to 30, a mean of 18.5, and a median number of tests of 20.5 (Table 3). Test results were pooled across patients to form a 2 × 2 table (Table 4). The χ^2 test statistic of 134.77 was statistically

Table 2. Allergens

Fungi, Mold, Yeast	Trees
<i>P chrysogen</i>	American elm
<i>A alternata</i>	Maple
<i>A fumigatus</i>	Mountain cedar
<i>A pullulans</i>	Sweet gum
<i>C albicans</i>	White mulberry
<i>C herbarum</i>	Foods
<i>E purpur</i>	Beef
<i>F proliferatum</i>	Blueberry
<i>M racemosus</i>	Chicken egg
<i>P betae</i>	Chocolate
<i>S herbarum</i>	Clam
Wheat smut	Corn
Dust Mites	Cow's milk
<i>D farinae</i>	Peanut
<i>D pteronyssinus</i>	Pork
Grasses	Raspberry
Bahia grass	Scallop
Bermuda grass	Sesame seed
Johnson grass	Shrimp
Kentucky bluegrass	Soybean
Timothy grass	Strawberry
Animal Dander	Walnut
Cat	Wheat
Dog	Insect
Horse	Cockroach
Weeds	
English plantain	
Mugwort	
Nettle	
Ragweed	
Sheep sorrel	
White oak	

Table 3. ART-IgE Test Comparisons Per Patient

Patient	True Positives	False Positives	True Negatives	False Negatives	Totals
1	8	1	13	0	22
2	11	3	7	1	22
3	0	2	11	0	13
4	11	2	0	1	14
5	0	2	6	0	8
6	17	1	6	1	25
7	0	8	15	0	23
8	0	0	9	0	9
9	18	2	1	0	21
10	7	1	3	1	12
11	23	1	4	2	30
12	2	2	13	0	17
13	3	3	14	0	20
14	11	3	8	1	23
Totals	111	31	110	7	259

Abbreviations: ART, autonomic response testing; IgE, immunoglobulin E.

Table 4. 2 × 2 Table of ART Examination and IgE Allergy Panel

ART Examination	IgE Allergy Panel		Total
	Positive	Negative	
Positive	111	7	118
Negative	31	110	141
Total	142	117	259

Note: Pearson's χ^2 test: 134.77 ($P < .0001$).

Abbreviations: ART, autonomic response testing; IgE, immunoglobulin E.

Table 5. Measures of Accuracy and Association

Statistic	Point Estimate	Exact 95% CI	Bootstrapped 95% CI
Sensitivity	0.78	0.70 to 0.85	0.72 to 0.84
Specificity	0.94	0.88 to 0.98	0.90 to 0.98
Positive predictive value	0.94	0.88 to 0.98	0.90 to 0.98
Negative predictive value	0.78	0.70 to 0.85	0.72 to 0.84
Overall accuracy	0.85	0.80 to 0.89	0.81 to 0.89
Phi coefficient	0.72	0.66 to 0.77	0.65 to 0.79
Cohen's kappa	0.71	0.63 to 0.79	0.63 to 0.78

Abbreviation: CI, confidence interval.

significant ($P < .0001$). Accuracy measure calculations for ART and their corresponding exact confidence intervals indicated sensitivity of 0.78 (95% CI, 0.70 to 0.85); specificity of 0.94 (95% CI, 0.88 to 0.98); positive predictive value of 0.94 (95% CI, 0.88 to 0.98); negative predictive value of 0.78 (95% CI, 0.70 to 0.85); and overall accuracy of 0.85 (95% CI, 0.80 to 0.89). Measures of association of ART with IgE testing indicated phi coefficient of 0.72 (95% CI, 0.66 to 0.77) and kappa statistic of 0.71 (95% CI, 0.63 to 0.79) (Table 5). There were no indeterminate test results and no missing test results.

DISCUSSION

This retrospective chart review assessment of the diagnostic utility of ART for allergies as compared with IgE blood testing indicated useful sensitivity, excellent specificity, excellent positive predictive value, and useful negative predictive value. The phi coefficient indicated a strong positive correlation between ART and IgE blood testing, whereas the Cohen's kappa indicated substantial strength of agreement.⁴⁰

Thus, the results of this retrospective case series indicated that ART was a useful allergy assessment tool when compared with a blood test IgE panel. The strength of the study was the absence of spectrum bias. Results could not be predicted from the clinical presentation alone. In most of the cases, allergy would not be high on the differential diagnostic list or not considered at all, as in the cases involving pain or fatigue. A possible source of bias was that the person performing the

clinical history and physical was also the person who performed the ART assessment. However, 51 specific allergens were tested. If someone presented with allergic rhinitis, it would be difficult to predict which specific allergen was related to the allergic rhinitis: elm, maple, cedar, Bahia grass, Bermuda grass, Johnson grass, Kentucky blue grass, cat dander, dog dander, and others (Table 2). For the complaint of fatigue, it would be difficult to specify which specific mold, food, animal dander, or any specific member of an allergen class was associated with the symptom. Other important questions are generalization across ART examiners and generalization to other patient assessment questions such as infections, optimum nutrient levels, and clinically relevant toxin levels.^{27,28,41} Further study is required to answer these questions. With regard to interrater reliability between clinicians performing ART, clinicians will need to be certified based on their performance compared with IgE allergy blood tests not with each other. It is predictable that there will be variability between clinicians in the performance of ART. Thus, certification based on performance compared to the standard reference test is needed. Future studies should incorporate designs in which clinicians have been vetted based on their performance compared to standard reference tests. Future prospective studies must also mask the ART examiner from any clinical information and from the presented allergen.

CONCLUSION

ART appears to be helpful in the allergy assessment of chronically ill patients who have found no resolution of their problems from standard medical assessment and treatment. This retrospective chart review evaluation of ART for allergy assessment serves as preliminary evidence. More vigorous prospective studies are indicated for replication and to test for generalization across ART examiners and other assessment questions. We welcome collaboration with other researchers.

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