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Original Article PEDIATRICS

Reaction frequency to the skin prick test of inhalant and food allergens in children

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ABSTRACT

OBJECTIVE: When applied by well-trained personnel, skin prick test (SPT) for a variety of inhalant and/or food allergens is a safe procedure although it may rarely cause systemic reaction. In this article, our aim was to evaluate the reactions after SPTs for the past 6 years in Turkish children having various allergic symptoms brought to our clinic.

METHODS: The results of the SPTs, performed between May 2013 and March 2019, of 12.529 patients whose ages vary from 2 months to 18 years have been retrospectively evaluated.

RESULTS: The average age of the patients who were included in this study was 6.12±4.38 years and 46.4% of them were female. When the patients were categorized according to the diagnosis, it was observed that 4.858 of them with symptoms suggesting asthma; 2.720 of them having symptoms suggesting allergic rhinitis; 1.795 of them having rashes; 906 of them with atopic dermatitis; 352 of them having symptoms suggesting food allergy and the remaining 1.898 with symptoms suggesting various diagnoses. In this study, which reflects our 6-year experience from the results of 12.529 patients, post-SPT reactions have been observed in 9 out of 12.529 patients (0.07%). They were three females and six males. These reactions were observed in 3 eczemas, 2 urticaria, 2 allergic rhinitis, and 2 suggested diagnosis of asthma patients. Their mean age was 5.9±3.5 years. SPT reactions were mostly seen in our five patients having skin disorder (eczema and rashes). The most frequent symptom of vasovagal reaction was syncope, occuring between 1 and 20 min after SPT, in eight of nine patients.

CONCLUSION: During our study, any systemic reaction or anaphylaxis to SPT was not observed. The non-systemic reaction (vasovagal reaction) rate was 7/10.000, similar to the literature.

Keywords: Anaphylaxis; hypotension; reaction; skin prick test, syncope; vomiting.

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The skin prick test (SPT) is an *in vivo* diagnostic test, most commonly used for the evaluation of allergic diseases since it is cheap, very sensitive/specific, and results in a short time. Moreover, it is generally the first choice test in the diagnostic workup for allergic disorders [1–4]. In a recent European Academy of Allergy and Clinical Immunology task force survey, the present practice for allergy diagnosis was found to be depending on SPT as first preference in approximately 2/3 of all allergic disorder types and in 90% of respiratory allergic diseases [5]. It is minimally invasive and has the benefit of testing various allergens up to 20 min. It is done by puncturing the skin, typically in the volar part of the forearm or rarely on the back, with a lancet/an applicator after dropping of an allergen extract. In children, it is far less distressing than venipuncture, used to obtain a blood sample to evaluate specific Immunoglobulin (Ig)E during *in vitro* tests [1–4].

The current studies have shown that SPT and *in vitro* specific IgE tests are rather concordant, but with distinct

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sensitivity and specificity different for each allergen [6, 7]. There is an excellent association (~85–95%) between SPT and *in vitro* tests. SPT is accepted worldwide, as an outstanding diagnostic tool, with a positive predictive value varying from 95% to100%. SPTs can demonstrate sensitivity to aeroallergens, foods, certain drugs, venom, and latex allergens. In clinical conditions, both tests should be utilized based on clinical characteristics in the history and acquired findings on examinations. Therefore, the significance of such allergen sensitivity should always be cautiously evaluated together with clinical history, since atopic sensitization and real clinical allergy may not concur [1–4].

Concerning reliability, while the reports of systemic reactions and specifically anaphylaxis, in the literature are very uncommon, *in vitro* serum IgE tests should be chosen if there are prior severe systemic reactions become known from the patient's clinical history [1]. In fact, when applied by well-trained personnel, SPT for a variety of inhalant and/or food allergens is a safe procedure although it may very rarely cause systemic reaction [8]. Here, our aim was to retrospectively evaluate the reactions after SPTs for the past 6 years in Turkish children having various allergic symptoms.

Highlight key points

- During this study, any systemic reaction or anaphylaxis to SPT was not observed.
- The most frequent symptom of vasovagal reaction was syncope, happening between 1 and 20 minutes after SPT.
- The non-systemic reaction (vasovagal reaction) rate was 7/10.000, similar to the literature.

Table 1. Demographics of our SPT patients

Characteristics	Numbers
Gender Female/Male	5.816/6.713
Average age	6.12±4.38 (1–18)
Diagnosis	
Asthma	4.858
Allergic rhinitis	2.720
Urticaria	1.795
Atopic dermatitis	906
Food allergy	352
Others	1898

SPT: Skin prick test.

MATERIALS AND METHODS

Demographic Characteristics

The results of the SPTs, performed between May 2013 and March 2019, of 12.529 patients whose ages vary from 2 months to 18 years have been evaluated retrospectively. This study was approved by the local institutional ethics committee (number: 71522473/050.01.04/32).

Diagnoses of the Patients

When the patients were categorized according to the diagnosis, it was observed that 4.858 of them with symptoms suggesting asthma; 2.720 of them having symptoms suggesting allergic rhinitis; 1.795 of them having rashes; 906 of them with atopic dermatitis; 352 of them having symptoms suggesting food allergy and the remaining 1.898 with symptoms suggesting various diagnoses (Table 1).

Skin Prick Testing

In order to determine the patient's sensitivity to allergens, multiple SPT method was performed by using an applicator (Expressten®, Medicaperk, Istanbul, Turkey). There were no venom, latex, and drug (antibiotic) allergens used for testing. There was also no prick-to-prick or intradermal testing enrolled in this study.

Data Acquisition

Clinical data from enrolled patients in the study were retrospectively acquired from the patients' files of our outpatient clinic to evaluate the reactions after SPTs for the past 6 years in cases having different allergic symptoms.

Statistical Analysis

Statistical analysis of the study was performed using the Statistical Package for the Social Sciences program (IBM SPSS Statistics, Version 23.0. Armonk, NY, USA). A $p<0.05$ was considered statistically significant.

RESULTS

The average age of the patients that involved in this study was 6.12±4.38 years and the 46.4% of them were female. In this retrospective study, which reflects our 6-year experience from the results of 12.529 patients,

post-SPT reactions have been observed in 9 out of 12.529 patients (0.07%). Out of these nine patients, three were female and six were male patients. These reactions were observed in the three patients with atopic dermatitis, two with urticaria, two with allergic rhinitis, and two with suggested diagnosis of asthma patients. Their mean age was 5.9±3.5 years. The youngest patient was 3.1/2-year-old female and the oldest one was a 13-year-old male. SPT reactions were mostly seen in our five patients having skin disorder (eczema and rashes). The most frequent symptom of vasovagal reaction was syncope, occurring between 1 and 20 min after SPT, in eight out of nine patients. In these four of eight patients, vomiting, tendency to sleep or confirmed hypotension was associated with syncope. Vomiting was associated with syncope in one patient; however, it was the only symptom in one case (#2) as well. Hypotension was accompanying syncope in two cases (#7 and #9). First hypotensive patient was an 11-year-old female and the second one was a 6-year-old male. Moreover, blood pressures of both patients were measured at 80/50 mmHg. Tendency to sleep was seen related with syncope in 1 case. Other vital signs of the patients were stable. Abnormal vital symptoms such as blood pressure of the patient turned to normal values in a short period of time. There was no further intervention needed except for Trendelenburg maneuver. Only one patient, 4-year-old female patient (#3) was monitored for a couple of hours due to parent's anxiety and tendency to sleep. None of the more serious or systemic allergic reactions e.g. respiratory distress or anaphylaxis was observed in any patient. There was no need for anti-histaminics, corticosteroid, and epinephrine use. None of the patients showed SPT and specific IgE positivity. The routine blood tests, such as complete blood count, CRP, biochemistry were all found to be normal. These symptoms seen in nine patients indicated vasovagal reaction (response) and its related symptoms. (Age, symptoms, and diagnoses of the reactive patients to SPT are presented in Table 2).

DISCUSSION

There have been earlier reports on fatal reactions, later systemic (non-fatal) reactions and reaction rate to SPT in the literature from various countries [9–13]. This is the first Turkish study surveying reactions to SPT from the center in Sakarya Province. In 1987, Lockey et al. [9] reported nine fatal reactions between 1895 and 1968 and six fatal reactions from 1964 through 1983. One of the six fatalities was tested with simultaneously SPT and intradermally; five were due to only intradermal testing. Bernstein et al. [10] described 12-year (1990–2001) survey of one deadly event after SPT. One fatal anaphylactic reaction was confirmed in a young woman with allergic rhinitis, moderate persistent but uncontrolled asthma and food allergy after application of SPT to 90 food antigens using a SPT device. Reid et al. [11] observed one skin test-related fatality in a follow-up of fatal events that occurred in their survey between 1985 and 1989. Norrman et al. [12] determined the systemic reaction rate after the SPT as 0.001% in a prospective study enrolling 5908 children. They defined vasovagal reaction rate as 0.12% . Sellaturay et al. [13] demonstrated systemic reaction rate as %0.077 in a 6-year long prospective study including 31,000 patients. The most likely causative allergens were food allergens. The relevant SPT wheal was ≥8 mm in 75% of them. In a study including 16,505 SPT patients from 1992 to 1997, Valyasevi et al. [14] detected systemic reaction rate as 0.03% for SPT. In their retrospective review querying the practice's electronic billing database by Swender et al. [15], there were 28,907 total patient encounters for SPT. This study showed a systemic reaction rate requiring epinephrine of 20/100,000 SPT visits.

Our literature overview showed that fatal and/or severe systemic reactions reported in the past literature seemed to mostly happen after intradermal injections, skin testing during allergy season, and/or skin testing done in uncontrolled asthma or sick patients. Reactions were also associated with skin testing to multiple food allergens and drug [8–17].

Although no systemic reaction or anaphylaxis has not observed in our study and rarely reported in the literature, all of the emergency equipment/medication including epinephrine must be ready to use during skin testing. The patients ought to be examined before a SPT and necessary precautions should be taken, especially for patients having uncontrolled asthma, polysensitization, and high degree of SPT reactivity with a specific consideration to such foods as all types of nuts, fish, etc [9].

Conclusion

In this study, there was no systemic reaction or anaphylaxis to SPT was not observed. The non-systemic vasovagal reaction rate was 7 out of 10.000 (9/12.529) cases, in concordance with the literature.

Table 2. Age, symptoms, and diagnoses of the reactive patients to SPT

Patient#	Age	Gender	Suggested diagnosis	Symptom	Tested inhalant allergens	Tested food allergens	SPT result	Total IgE	Specific IgE or other tests	Intervention
No. 1	3 y 7 mo	Female	Asthma	Syncope	Df, Dog, Chenopodium album, Cladosporium, Meadow Fescue, Cupressus	Hazelnut, fish mix	Negative	–	–	Trendelenburg
No. 2	3 y 6 mo	Male	Atopic dermatitis	Vomiting	Dp, cat, alterneria, Chenopodium album, cereal mix	Cow's milk, peanut, whole hen's egg	Negative	–	–	–
No. 3	4 y 4 mo	Female	Allergic rhinitis	Syncope, Tendency to sleep	Df, Dog, Chenopodium album, Cladosporium, Meadow Fescue, Cupressus	Hazelnut, fish mix	Negative	17.8 IU/ml	Food, tree-grass pollen and mite: negative	Trendelenburg
No. 4	13 y 1 mo	Male	Urticaria	Syncope	Df, Dog, Chenopodium album, Cladosporium, Pine, Cupressus, English plantain, Cereal mix	–	Negative	<18.2	Cow's milk, egg, nuts, fruits: negative	Trendelenburg
No. 5	10 y 3 mo	Male	Urticaria	Syncope	Dp, cat, alterneria, Meadow Fescue, olive, ash, nettle, Mugwort	–	Negative	–	Inhalant and food allergen screening: negative	Trendelenburg
No. 6	4 y	Male	Atopic dermatitis	Syncope	Df, Dog, Chenopodium album, Cladosporium, Meadow Fescue, Cupressus	Hazelnut, fish mix	Negative	–	–	Trendelenburg
No. 7	11 y 1 mo	Female	Atopic dermatitis	Syncope Hypotension	Dp, cat, alterneria, Meadow Fescue, olive, ash, nettle, Mugwort	–	Negative	–	Spirometry: normal	Trendelenburg
No. 8	5 y 6 mo	Male	Chronic cough, asthma?	Syncope, vomiting	Df, Dog, Chenopodium album, Cladosporium, Cupressus, Meadow Fescue	Hazelnut, fish mix	Negative	–	–	Trendelenburg
No. 9	5 y 10 mo	Male	Allergic rhinitis	Syncope, Hypotension	Dp, cat, alterneria, Meadow Fescue, olive, ash, nettle, Mugwort	–	Negative	–	Spirometry: Mildly low FEV1, FVC	Trendelenburg

Dp: Dermatophagoides pteronyssinus; Df: Dermatophagoides farina; FEV1: Forced expiratory volume in 1 second; FVC: Forced vital capacity. SPT: Skin prick test; y: Year; mo: Month.

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